PUBLISHED EVERY SATURDAY BY

THE W. J. JOHNSTON COMPANY, Limited,

167-177 TIMES BUILDING, NEW YORK.

Established 1874. Incorporated 1889.

Telephone Call: Nassau 924. Cable Address: "Electrical," New York.

New England Office, 8 Cook Building, Boston.
Western Office, 39 Mallers Building, Chicago.
Philadelphia Office, 31 City Trust Building.

SUBSCRIPTION, IN ADVANCE, ONE YEAR, $3.

(Including Postage in the U. S., Canada or Mexico.)

IN CLUBS of four or more, $2.50 a year each; with a free extra copy to the getter up of a club of 8. Foreign subscription, $5 a year.

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Times Building, New York
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VOL. XV. NEW YORK, MARCH 8, 1890. No. 10.

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Electric Transfer Tables. RAILROADS are notoriously conservative in their adoption of new devices, and the acceptance by them of an innovation may be safely regarded as an acknowledgment of its superiority. The rapid increase in the number of electric transfer tables is therefore a good indication that this method presents more than one advantage over the old type, and that it is only a matter of time when their employment will become general.

Electric Position Finders. IN a recent issue we described an ingenious method devised by Lieut. Bradley A. Fiske, U. S. Navy, for finding the range of distant objects. Following out the same idea, Lieut. Fiske has recently elaborated the principle, so that the position of distant objects may be exactly located with reference to a given point. As a result, a gun may be pointed toward and ranged to fire at an object which is entirely invisible to the gunner. The means employed to accomplish this are extremely simple, being but a rational application of the Wheatstone bridge, in which resistances are made the equivalents of angles and lengths.

The Electric Motor Meter. ON more than one occasion Mr. Edison has indulged his playful propensity for springing "fundamental" patents upon the electrical public, and that he has not yet gotten over this practice is evidenced by the suit which has just been instituted by the Edison Company to enjoin the use of the Shallenberger meter, on the ground that it infringes the Edison patent covering a meter in the form of an electric motor, the speed of which is made proportional to the strength of the current passing in the circuit. It is interesting to note that though early contemplated by Mr. Edison, this type of meter was considered by him inferior to the chemical meter, on the score both of cheapness and of accuracy, an opinion to which Mr. Edison still adheres. It was therefore, it is said, not introduced in connection with his system of incandescent lighting.

Phenomena of Recalescence. THE important part which the phenomena of recalesence and decalescence are undoubtedly destined to play in the manipulation of iron and steel in the near future, when they have been more closely studied and reduced to practical applications, makes the early history of their discovery one of interest to all. Prof. Elihu Thomson, as our readers are aware, had occasion, with his wonted acuteness, to note the phenomena in a very marked way while experimenting with his welding process, and their nature is well described by Mr. Robert Shand in another column. Mr. Shand also propounds a question which, as he says, it would be interesting to determine, *i. e.*, whether or not it is possible for the same piece of steel at the same temperature, before and after recalescence, to exist in two different states as regards its capacity for magnetization.

Postal Telegraphs. ONE of the best beaten and most familiar tracks of investigation by Congress is the telegraph industry as a proposed adjunct to the responsibilities of the national government; but it seems as though the average senator or representative never will tire of getting some prominent telegraph man on the stand and probing him with questions. This is the kind of thing now going on at Washington, and Dr. Green has once more had the opportunity of going over the statistics of the subject and of stating the case for private management and control. The worthy doctor is evidently growing a little impatient of the baiting, and having nothing new to advance in support of his already strong and fully stated case, chafes at being carelessly invited to waste his time traversing all the old facts and principles. It is a pity something cannot be done to check the growth of the literature of telegraph investigation, for it is all repetition, time and time again.

Electric Railways and the Telephone. FOLLOWING close upon the adverse decision of Judge Taft, in Cincinnati, which was printed in full in our last issue, comes that of the Supreme Court of the State of New York, which was called upon to decide a similar question between the Hudson River Telephone Company and the Watervliet Turnpike and Railway Company. The decision, whose gist we give elsewhere, is unequivocally in favor of the electric railway company, the judges being of the opinion that the well-known remedy to avoid the trouble, the construction of metallic circuits, must be applied by the telephone company. The only question still considered open for argument by the court was as to who shall bear the expense of converting the ground circuits of the telephone company into metallic ones. It is evident that the array of decisions in these cases, which are rapidly increasing, will soon lead to a definite settlement of this question; and we believe that amicable arrangements between the two interests will be brought about.

Electric Heating. THE enormous heating power of the electric current, which the introduction of the dynamo demonstrated, led to the early suggestion that the current, besides its utilization for light and power, might be employed as a heating agent. Without entering into the possible economy of such an employment of the electric current as compared with the other methods now in use, it is beyond question that, as a heating agent pure and simple, there is none which is more perfectly adapted to the purpose than the electric current, supplied, we will say, from a central station. It furnishes heat without any of the accompaniments which are invariably the adjuncts of other heating methods. An ingenious apparatus for this purpose, adapted specially for employment in connection with the alternating current, is that described in another column, in which the secondary of an induction coil is made in such a form as to generate a maximum of current to produce the desired heating. As the inventor naively suggests, the heating of the iron core, so objectionable a feature in the usual alternating current apparatus, presents no obstacle to the successful operation of the electric heater, and might indeed be classed as one of its advantages.

Invention and Patents. THE final adjudication of the celebrated case of Morse *vs.* O'Reilly left the courts almost entirely free from electrical litigation for a period of over thirty years; but the enormous development of electrical applications within the last decade, with its thousands of electrical inventions, has again given the courts much work to do in determining the claims of rival inventors. The question of what is patentable is therefore one of interest to all electricians, and the answer to this question is well given or suggested in the admirable address of Mr. Grosvenor P. Lowrey, delivered before the Electric Club of this city. The distinction between what constitutes invention and the exercise of mechanical skill, must evidently often lead to conflicting opinions, and though certain general rules may be laid down, the question on the whole will, it seems, always be a debatable one. As one who has participated in not a few fierce legal contests, Mr. Lowrey probably speaks from the heart when he declares that only to be patentable for which a patent can be obtained and kept. Mr. Lowrey also draws vivid pictures of the effect of some of our patent laws and the hardships they may entail on our own inventors. We do not think that Mr. Lowrey has stated the case any too strongly, and we hope that coming decisions may soon settle the points in question, or that inventors, recognizing their rights, will compel Congress to relieve them from the operation of senseless and pernicious laws.

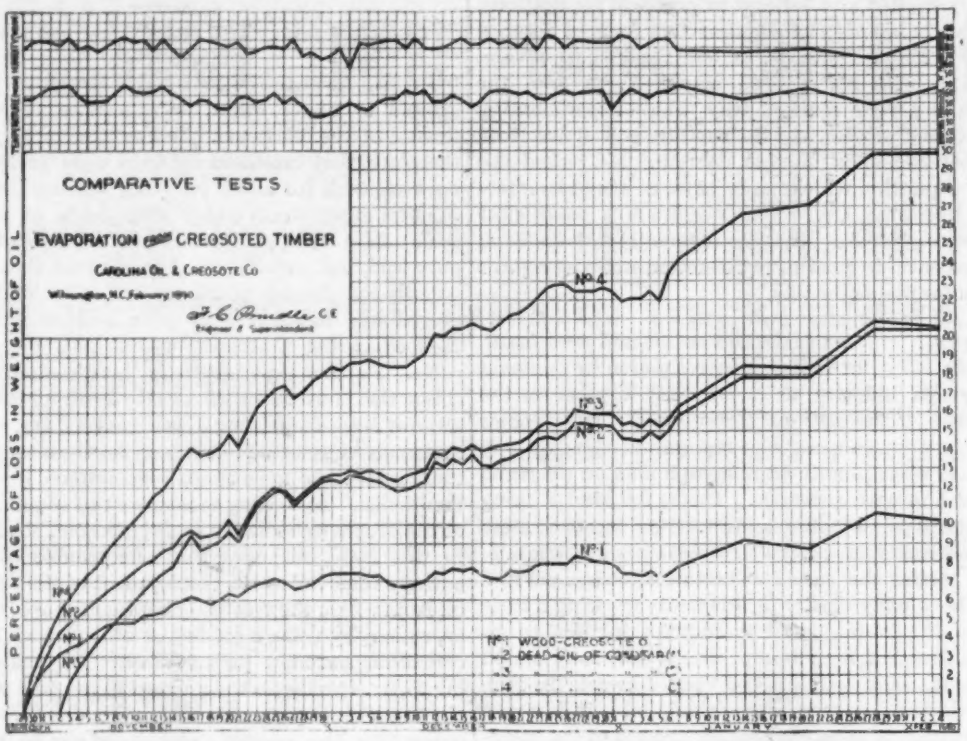
Creosote and Lead Cables. THE preservative qualities which creosote imparts to wood have made that material a favorite one for wooden structures placed underground or under water, or otherwise subject to the influence of the elements. It was not to be wondered at, therefore, that creosoted conduits were early suggested as the receptacle for cables carrying electric conductors. In the first experiments which were made in this direction, these cables were, as theretofore, inclosed in a covering of pure lead, but experience soon showed that some of the volatile constituents of the creosote attacked the lead and played sad havoc with it after a short while, rendering the lead casing practically useless as a protector for the cable. Further experiments in this direction indicate that this action is far less with a cable covering consisting of an alloy of lead containing 3 per cent. of tin; but while the action above referred to has been for the most part obviated there is still said to be trouble encountered due to the cause mentioned. In seeking to remove this objection to the use of the otherwise valuable agent, creosote, Mr. F. C. Prindle, in this issue, intimates that the trouble can be almost entirely removed by the employment of the proper creosote oil from which the volatile constituents have been removed, or, rather, by using a quality of oil in which these volatile constituents are not present at all. This material, according to Mr. Prindle, is to be found in the true wood creosote oil, and the experiments which he cites would seem to prove that the trouble experienced can be largely, if not entirely, overcome by the use of such oil in preference to others in which these volatile constituents exist.

The World's Fair. THE indications are that the World's Fair and International Exposition, regarding which the country has been so stirred up, will be held in the city of Chicago. It is time, therefore, that those connected with the great electrical industries of America should carefully and calmly consider the importance, character and scope of this gigantic undertaking. In common with most New Yorkers, we had the idea that our own city possessed many advantages that would render it the proper place for a world's fair. Now, however, that the prize has been awarded to the energetic western competitor, we believe that all sections should co-operate heartily with the citizens of Chicago in making the Fair the success that it ought to be. THE ELECTRICAL WORLD, being a national journal, aims in matters of national importance to be as broad as the continent, and it will, therefore, be found to work as energetically for the success of the Fair in Chicago as it would have done had it been held in New York. We commend to electricians, electrical manufacturers, inventors and others connected with or interested in electricity, the necessity of timely action in the matter of preparation. In no single department of applied science will there be more interest shown or more good results attained than in that of electricity. The industry is new, the field is almost unlimited, and the world, looking on in wonder and admiration at what has already been accomplished by the aid of electricity, is eager to increase its meagre knowledge of the nature and operation of the various electrical appliances. The World's Fair will offer an opportunity of bringing electrical apparatus, machinery and devices in a practical manner before all classes of the community, and also before many purchasers from abroad, that will not, we are sure, be allowed to pass unimproved. Held in Chicago, the Fair will be national and international in its scope, and must be no less a complete exhibition of our products, industries, arts and manufactures. These great national fairs are educators, and develop commerce. The Centennial Exposition of 1876 operated directly as a stimulus to trade, both domestic and foreign. The World's Fair in New Orleans, although from its disadvantageous situation it did not score a success in point of attendance, exerted a decided influence in aiding the wonderful development of the natural resources and wealth of the new south, which for the past six years have attracted so much attention. To the Paris Exposition (the most successful ever held) is given the credit of reviving the flagging industries of France. In fact, many say that it has done as much toward enhancing the security of the Republic in France as any other political event in its recent history. Chicago will always be popular with electricians, and is already the centre of no small amount of electrical work. Memories of the electric light convention of 1889 linger pleasantly with all. The hospitality of the Chicago Electric Club will always be a delightful reminiscence. Having ceased to regard as a joke the pressing invitation extended by Mayor Cregier at the reception to the Eastern delegates while en route to Kansas City, electricians here will now cordially accept it. THE ELECTRICAL WORLD believing that the World's Fair, if held in Chicago, should be made a great national success, has subscribed $500 toward the fund being raised in its aid.

Evaporation of Phenols, Etc., From Creosoted Timber.

BY F. C. PRINDLE, C. E.

The recent discussion on the value of creosoted material, in connection with the evaporation of phenols from electrical conduits of wood "creosoted" with dead oil of coal tar, which appeared in Mr. J. C. Riley's paper on "Underground Conduit Construction," which was printed in THE



EVAPORATION OF PHENOLS, ETC., FROM CREOSOTED TIMBER.

ELECTRICAL WORLD of Sept. 21, 1889, has suggested a series of experiments to ascertain the comparative loss by evaporation, under ordinary atmospheric influences, of the dead-oil generally used for creosoting, and of the true wood-creosote oil as now manufactured and employed exclusively for creosoting purposes under the writer's supervision at Wilmington, N. C.

This discussion elicited the fact that the phenols (tar acids) of the dead oil escaped from the wood, and attacked the lead sheathing of telephone cables, forming a phenolate of lead, and to such an extent that it has been thought desirable to have such material exposed to the air or to provide artificial means for evaporating the phenols, if the creosoting oil cannot be obtained without it, before placing the conduits underground, as after a few years this destructive agent disappears almost entirely or loses its potency for further mischief in this direction.

This early loss of a portion of the preserving agent, originally injected into the wood, has suggested another query of no small moment, akin to the infant's epitaph.

"What was I begun for,
If so soon I'm to be done for?"

as well as the expediency of the Hibernian idea to take out this elusive and worse than useless ingredient before it is put in. The results of these experiments have thrown so much light on the question, of a surprising and somewhat unexpected sort, and are of such commercial significance as to warrant their presentation to the attention of electrical engineers and others interested in the use of creosoted material.

The first series of tests have been made with three different samples of commercial dead-oil, from as many barrels, obtained as average samples from leading manufacturers, and a sample of wood-creosote oil taken from our working tanks in daily operation.

Four sets of wood specimens, of two pieces each, were prepared of kiln-dried North Carolina pine lumber, dressed, 4 inches square and 13½ inches long, and impregnated as nearly as possible with 12 pounds of oil per cubic foot. They were then suspended side by side, under shelter, and carefully weighed daily for ten weeks and weekly thereafter, having been subjected to exactly similar conditions throughout.

The results have been plotted on the accompanying diagram, each line representing the mean of the two pieces under test, the losses at the end of each week only being here tabulated, as follows:

Loss by evaporation in per cent. of weight of oil injected:

No. of sample	1	2	3	4
	Per cent.	Per cent.	Per cent.	Per cent.
1st week	4.03	5.68	5.43	7.42
2d "	5.24	8.11	9.51	11.54
3d "	6.04	9.59	11.14	14.15
4th "	6.98	11.76	12.50	17.45
5th "	7.39	12.70	12.50	18.68
6th "	6.85	12.03	14.13	18.82
7th "	7.25	13.24	14.40	20.47
8th "	7.93	14.73	16.03	22.67
9th "	7.93	15.27	15.63	23.49
10th "	7.79	15.81	17.54	24.18
11th "	9.14	17.83	18.40	26.64
12th "	8.73	17.83	19.70	27.06
13th "	10.62	20.41	20.38	29.81
14th "	10.22	20.41	20.52	29.81
Ratio	1.	1.99	2.00	2.91

It will be observed that the loss was rapid for the first few days, after which the rate was more or less influenced by atmospheric conditions, No. 1 having remained nearly stationary from the fifth to the eleventh week, while the ratio of loss of the others continued to increase.

From this it appears that the 12 pounds of oil originally injected have been reduced by evaporation to the following amounts:

No. 1, 10.77 pounds; No. 2, 9.55 pounds; No: 3, 9.53 pounds; No. 4, 8.42 pounds; a result of much commercial significance as affecting the permanence of the preserving agents in creosoted material.

Upon this basis the presence of say 10 pounds of oil per cubic foot remaining in the wood after such exposure to the air will call for the original injection of oil, as follows: No. 1, 11.13 pounds; No. 2, 12.56 pounds; No. 3, 12.58 pounds; No. 4, 14.24 pounds; and for the presence of 12 pounds per cubic foot, as follows: No. 1, 13.36 pounds; No. 2, 15.07 pounds; No. 3, 15.09 pounds; No. 4, 17.09 pounds. Or, in other words, to secure equal effects on the usual specification basis of creosoting with 12 pounds of oil per cubic foot there will be required an original injection of oil as follows: No. 1, 12 pounds; No. 2, 13.53 pounds; No. 3, 13.55 pounds; No. 4, 15.34 pounds.

The marked difference shown in the volatilities of the several oils indicated a like difference in their quality and composition, which has been fully substantiated by a careful chemical analysis and investigation of each separately, which also verifies the fact of the marked want of uniformity existing among the dead oil samples themselves.

Chemical investigation also serves to explain and support the experimental results given, as it discloses the several constituents of different oils and supplements the evaporation tests in a most satisfactory manner. The following are the analyses of the several oils tested, arranged for ready comparison of their corresponding constituents and showing per centages by weight.

COMPARATIVE ANALYSES OF WOOD-CREOSOTE OIL (1), AND DEAD-OILS OF COAL TAR (NOS. 2, 3, 4), EMPLOYED FOR CREOSOTING PURPOSES.

No. of sample.	1 Per cent.	2 Per cent.	3 Per cent.	4 Per cent.
Water, mechanically contained	2.08	0.50	0.24	0.42
Water of decomposition	0.71	.....	....	.....
Indifferent oil, distilling below 534 deg. Fahr.	13.16	21.62	42.47	48.50
Crude creosote	17 00	.....	.....	.....
Tar acids	.....	9.72	15 34	16.63
Heavy oil, distilling above 534 deg. Fahr.	26.55	.....	.....	.....
Wax (paraffin resin)	25.97	.....	.....	.....
Naphthalene	.....	67.50	40.23	27.77
Coke	5.78	0.28	1.49	6.42
Loss	8 75	0.29	0.23	0.26
	100.00	100.00	100.00	100 00
And by volume,				
Distillate under 534 deg. Fahr.	26.00	77.00	61.00	78.00
Distillate under 600 deg. Fahr.	35.75	86 00	78.50	90.00
Residue under 600 deg. Fahr.	64.25	14.00	21.50	10.00

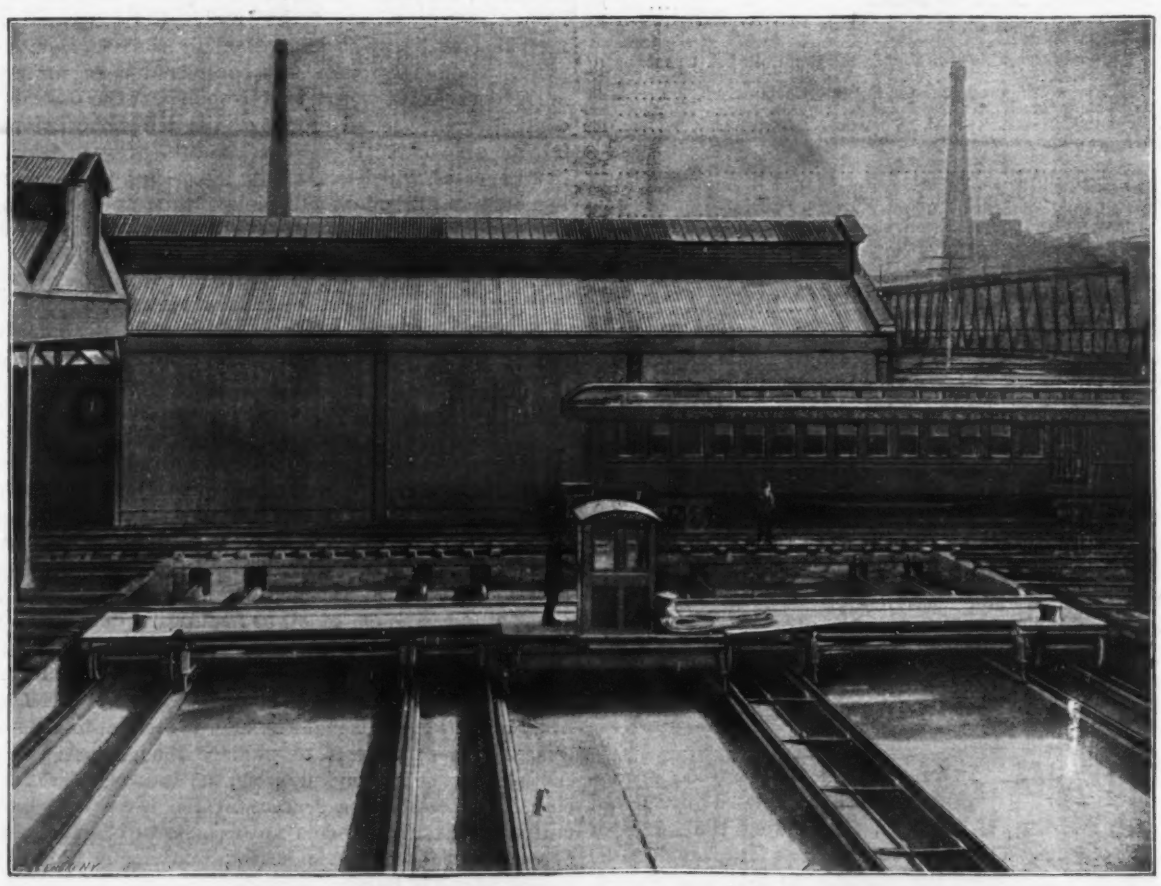
In comparing the relative percentages of the heavy and stable bodies, it should be borne in mind that the coke and loss of No. 1 exist as heavy oil and paraffin in the wood-creosote oil, which requires such a high temperature, during the final stages of distillation in the laboratory still, as to decompose the oil to this extent. This relatively higher heat, demanded with this oil, is also naturally indicated by the much greater percentage of residue remaining undistilled at 600 degrees Fahr., and also by the water of decomposition produced.

The large percentages of the volatile tar acids and indifferent oils found in these dead-oils and of their distillates coming over, under 600 deg. Fahr., naturally suggest some appropriate modifications of the usual form of creosoting specifications in these respects.

These analyses have been carefully made by Franklin S. Clark, E. M., Ph. D., and on the same line of investigation in every respect. The details of these experiments have also been made under the personal supervision of Dr. Clark, who has had much experience in the operations of destructive distillation in general and the analytical investigations of wood products, on a commercial scale, in particular.

The results herein shown also confirm the importance and value of the recent improvements made in the manufacture of our wood-creosote oil, and exhibit in a striking manner its superior qualities and value as a preserving agent.

We propose to continue these experiments with a duplicate series of similar specimens, for comparison; also with the different constituents of each kind of oil separately, and still others for solubility, the results of which will be awaited with interest.



SPRAGUE TRANSFER TABLE, NEW YORK CITY.

Electric Transfer Table, New York Central & Hudson River Railroad.

We illustrate in this issue an electric transfer table recently installed by the Sprague Electric Railway and Motor Company for the New York Central & Hudson River Railroad. These tables differ from the earlier ones, which have been described in these columns, chiefly in the electric motor, which is of 15 h. p., instead of 7½ h. p., and also in the contact arrangement. The contact is obtained from a couple of heavy copper wires, stretched taut about three feet apart, over the second of the four parallel tracks, the wire

being carried on insulators fixed to light cast-iron cross-beams, so as to be a few inches above the rails. The conductors are kept taut under all changes of temperature by springs at one end. Over these wires two contact rollers travel beneath the table, being kept in contact by gravity only. In the Aurora electric transfer table, installed by the Sprague Company for the C., B. & Q. R. R., there is an outer contact maintained by springs, while at the Waukesha electric transfer table, installed by the Sprague Company for the Wisconsin Railroad Company, there is an overhead contact, The current used is only 220 volts, and hence, while not particularly pleasant to take in one's body, it is in no way dangerous. The current is taken from the same dynamo that furnishes light for the station.

The full current capacity of the table motor is 60 ampères. The speed of the motor is governed by a switch which throws the winding of the field into different combinations, thus altering the current, maintaining a practically constant strength of field without the use of any wasteful resistance. The control over the speed of the motor is perfect, and no complicated nest of gearing for changing speed is required.

The motor is supported at one end, according to the regular Sprague method, by double compression springs playing upon a bolt which rests upon the platform of the transfer table, this method being developed in street railway work and other places where it is desirable to start slowly under a heavy load, and has proved very satisfactory. At the other end the motor is sleeved on a rigid support. By means of this flexible attachment all danger of stripping the gears is eliminated, and the strain upon the gears is always a progressive one.

The advantages of electric power for this work are claimed to be great. The equipment is very much lighter than if steam power were used, and there is no expense of operation when the table is not in use. One man can easily handle the table, and more conveniently and directly than with steam.

The two end capstans shown on the table are fixed; the centre one is revolved in either direction by a simple clutch gear. It is used, of course, for working cars on to or off the table without locomotive power. The capacity of the table is 100,000 pounds. Ordinary car axles, bearings and wheels are used throughout for the running gear, and the total cost of the table and motor complete was under $7,000. Its speed is about 150 feet per minute, the same as the old wire rope table which it replaced. The old pit was lengthened somewhat, and accommodates ten tracks. The rails are carried on wooden longitudinals resting on small masonry foundation walls.

The pit drains directly into the city sewers. The table is constructed with 15-inch cross beams and 12 inch longitudinals, thoroughly braced with a rigid lateral system. It was designed and built by the Yale & Towne Manufacturing Company, of Stamford, Conn. The small cabin, shown at the centre of the table, is provided for the operator. Electric transfer tables have now been adopted by the Pennsylvania Railroad Company, Philadelphia & Reading Railroad Company, Chicago, Burlington & Quincy Railroad Company, Wisconsin Central Railroad Company, and other prominent corporations, and they are now recognized as an essential feature of every extensive and well-equipped railway switch yard. To Messrs. Dowd & La Rue, the local agents of the Sprague Company, the installation of the transfer table above described is due.

The Weymouth, Mass., Electric Light Station.

We take pleasure in illustrating this week the new station at Weymouth, Mass., recently erected and designed by Messrs. John Post, Jr., & Co., of Boston. The station consists of a brick building 75 feet long by 40 feet wide, two stories high, with boiler room attached, one story high, and measuring 32 feet by 40 feet. The smoke stack is also of brick, 100 feet high, with a four-foot flue, and gives ample draft for the boilers. The two boilers are of steel, and were built by Messrs. E. Hodge & Co., of Boston. They are 6 feet in diameter with 15-foot tubes. They are of the butt and joint type, carry 120 pounds of steam per square inch, and are 100 h. p. nominal, though capable of furnishing steam for a 350 h. p. engine. A Duplex feed pump and a Dodge injector, manufactured by the National Tube Works, of Boston, furnish the power for feeding the boilers, and the feed water is heated by a Hohenstein heater. A Spencer damper regulator has been added for automatically regulating the draft. The main steam pipe is of wrought iron, 10 inches in diameter, and covered by magnesia sectional covering, which is rapidly coming into favor among engineers as a non-conductor of heat. In the engine and dynamo room are an Ide compound condensing engine, with cylinders 13 inches and 22 inches, by 18 inches stroke, making 175 revolutions per minute, and one single cylinder condensing Ide engine, having cylinder 10 inches in diameter by 14 inches stroke, making 300 revolutions per minute. The condenser is an independent jet condenser, manufactured by the Barr Pumping Company, of Philadelphia, and is of duplex pattern, taking water from the river, 400 feet distant, through an 8-inch pipe, and raising the water 18 feet at low tide. The countershaft, fitted with two Hunter friction clutch pulleys, is driven by belting, manufactured by Gates & Co., of Lowell, from the large engine. It is coupled direct to the small engine, and is arranged so as to cut out either engine, or any dynamo. The latter have idler pulleys.

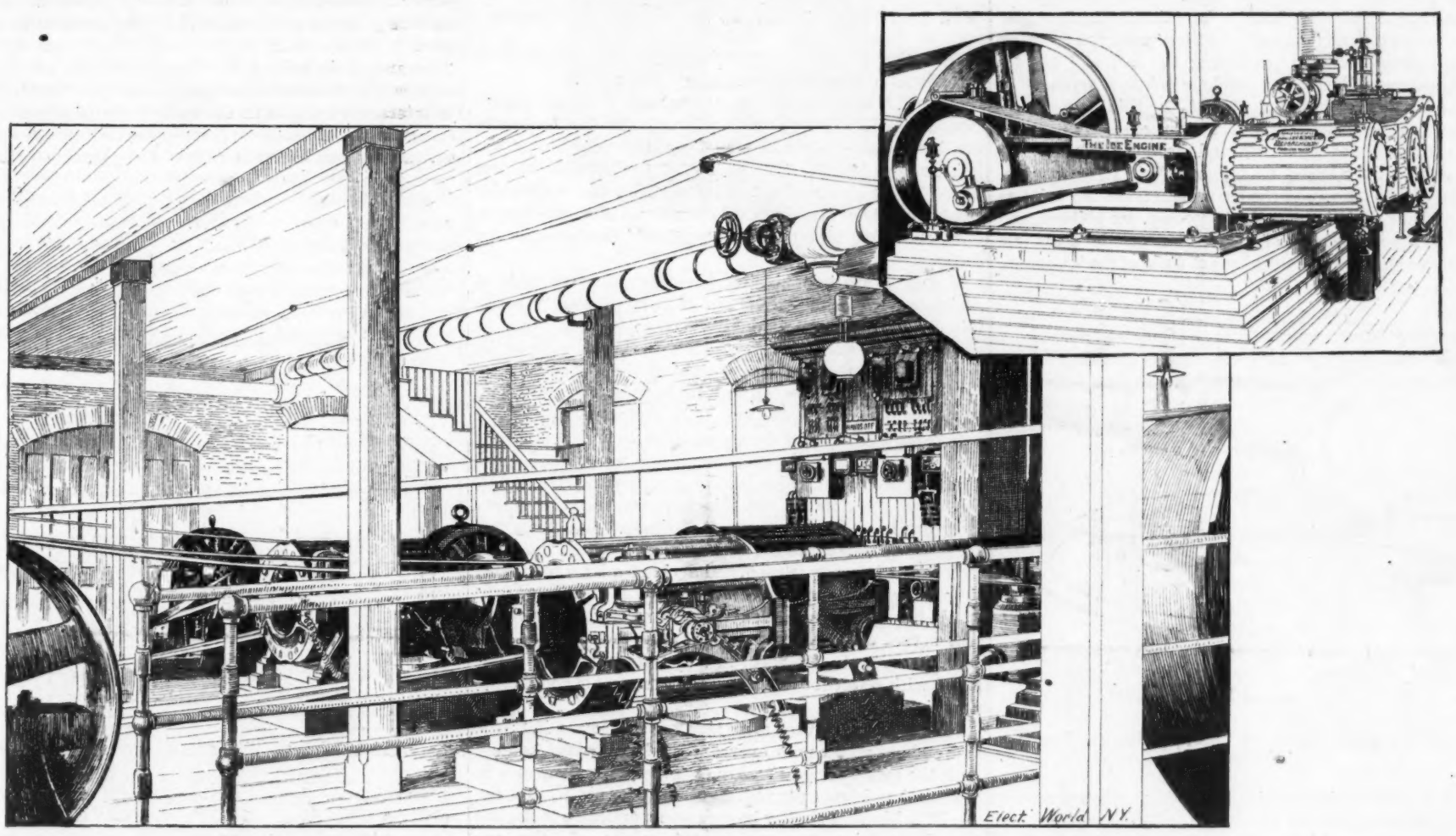
The electrical equipment consists of three LD[12] Thomson-Houston arc dynamos of 50-lights capacity each, and two compound wound Thomson-Houston alternating dynamos, each of 650 lights capacity. On the arc light circuits there are at Hingham, Mass., 145 32 c. p. series incandescent lamps and one arc lamp. On the East and North Hingham circuit are eighteen arc lamps and six 32 c. p. series incandescent lights, besides one arc lamp and six series incandescent lights in the station. On the circuit comprising South Weymouth and Weymouth are thirty-two arc lamps and twelve series incandescent lamps, making a total at present of fifty-two arc lamps and 169 series incandescent lamps of 32 c. p. The alternating dynamos are specially wound for 1,100 volts, there being some extremely long circuits, and each dynamo is furnished with a type 1[B] exciter, each exciter capable, if required, of exciting both dynamos, and arranged for so doing at the switch-board.

The arc light switchboard is of the regular Cutter pattern and stands away from the wall 12 inches, in accordance with the Insurance Exchange rules. All wires are run on rubber hooks and between porcelain knobs, and glass floor insulators are used in every case where the wires run through partitions or holes in the switchboard. The lightning arresters are all placed on the upper floor of the building, and are arranged neatly in a peculiar manner, which makes the effect pleasing to the eye, and secures the necessary protection at a distance from the dynamo.

The incandescent switchboard is of the cabinet type, and was built specially to meet the conditions, being very compact, and yet leaving an abundance of room between the terminals and wires, to prevent the maintenance or even the formation of an arc between them under any circumstances.

The wiring is all neatly done on the back of the board, and held rigidly in place by porcelain cleats and knobs. Circuit breakers are used for bridging. and glass floor insulators are used in bringing the wires through the board to their proper terminals. A system of spring contacts, with cells and electric bells, is used for calling the attention of the engineer or attendant in case any one of the 16 fuses on the feeder boards should be blown, and a permanent "ground detector" is in circuit with each line.

All the lines have been protected with the Davis tree insulator where trees are encountered, and are remarkably free from grounds. About 1,200 16 c. p. incandescent lamps are now in use, though there are prospects for a much larger number in the near future.



THE ELECTRIC LIGHT STATION AT WEYMOUTH, MASS.

The plans of the entire building and steam plant, and the arrangement of the dynamos, were made by John Post, Jr., & Co., who carried out the complete erection and construction under the immediate supervision of Mr. E. E. Worden, superintendent for the firm.

The entire steam plant was also furnished by Messrs. Post, and the Ide engines are reported to be doing exceptionally good work with a heavy load. These engines are giving great satisfaction for electric light plants as furnishing very steady power, as well as being economical of steam, and requiring very little care. The station is now under the supervision of Mr. William M. Davis, a thoroughly competent electrician, who also superintended the electrical equipment. Mr. Davis is ably seconded by Mr. D. E. Badger, the engineer. Altogether the station presents a very handsome appearance, and is a source of pride to Messrs. John Post, Jr., & Co., who are rapidly becoming one of the most important and progressive firms of engineers and contractors in New England.

Continuous Currents from the Induction Coil.

To the Editors of The Electrical World :

I have been reading with great interest the items published in your valuable paper upon the subject of "Continuous currents from alternating currents," and it has occurred to me that I would like to know how it will be possible to obtain a continuous current from alternating currents such as those received from an induction coil, where the alternations are so short. A CONSTANT READER.

[ANSWER.—In reply to our correspondent, we can only say that the possibility of accomplishing the object he cites by the methods described in our columns can best be demonstrated by actual experiments. The explanations put forward in the various articles seem to us sufficiently clear, so that their truth or falsity can be established by actual demonstration.—EDS. E. W.

Lieutenant Fiske's Position-Indicator.

In our issue of Feb. 8 we described Lieut. Bradley A. Fiske's invention for finding the distance of far away objects. We shall now proceed to describe an invention by the same officer whereby not only is the distance and exact position of a far away object determined, but whereby also any number of guns located at different points and at various distances from that object and from the instrument may be directed upon the object with certainty and dispatch, though enveloped in the impenetrable smoke of battle.

The invention has a special reference to forts containing a number of guns variously disposed. That a mere distance-finder does not meet the necessities of a fort will be evident from a glance at Fig. 2, from which it will be seen that the gunners at *C*, *D* and *E* are benefited little by knowing how far away the enemy's ship is from the instruments at *K* and *L*. The men at each gun must know how far the target is from that gun and in what direction; evidently the knowlege of the direction and distance of the target from *C* will help the gunners at *E* very little.

The present practice in most of the nations of the world to divide a harbor and adjacent waters into imaginary squares, each square being, say, one hundred yards on a side, and these squares are numbered. Two telescopes are situated at the ends of a known base line, and these tele scopes are electrically connected with a protected room, in which is placed a chart representing the fort and the adjacent waters, and carrying two long pointers arranged to sweep over the chart, and pivoted at the points representing the two telescopes. The men at the telescopes direct them continually at the target, and keep the officer at the chart constantly advised as to how their telescopes are pointing. The officers at the chart then point the pointers in the same direction as the telescopes are pointed, and therefore the intersection of the pointers on the chart represents the intersection of the lines of sight of the telescopes,

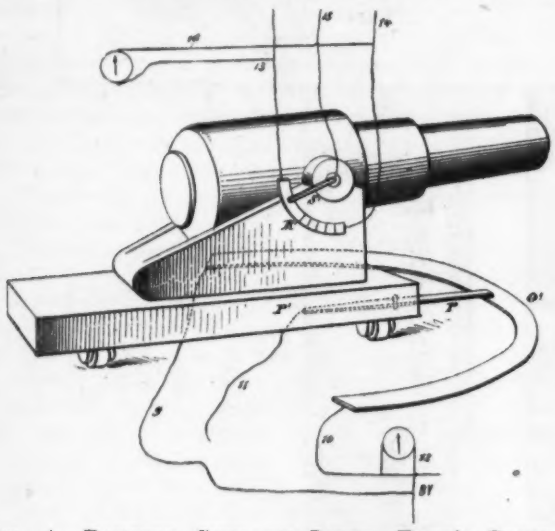


FIG. 1.—RANGING GUNS BY LIEUT. FISKE'S POSITION FINDER.

that is, represents the target. The officer then notes the number of the square on which the pointers intersect, and signals to the guns this number. The officer in charge of each gun then consults a table to ascertain how he must lay his gun to fire into that square, and trains and elevates his gun accordingly.

This plan is a fairly good one if the enemy is stationary; but if he is moving it has a number of defects; although even if he is stationary, the squares, of necessity, are too large to admit of very accurate shooting. If the enemy is moving the additional difficulties of the above plan arise from the great time lost between the instant at which the position becomes known to the officers at the chart and the instant at which the gun is finally elevated and trained. Another is, the number of different errors that may arise; these are, first, the error in noting the square at which the pointers intersect; second. the error in signaling the square; third, the error in reading the signal; fourth, the error in consulting the necessary tables; fifth, the error in transmitting the instructions to the men as to how to train and elevate; and sixth, the error in laying the gun according to those instructions, both in azimuth and altitude. To avoid any inaccuracy owing to the time that is lost, Major Watkin, by his method, predicts the position in which the enemy will be, say in half a minute, or a minute in advance, and the guns are got ready to fire when the signal is made that the predicted position has been reached by the enemy's ship. Now this feature of predicting entails several chances of error, necessitates a speed-measuring device, and also necessitates a preconcerted division of the harbor into squares, or otherwise, so that position points can be readily designated.

By the plan here described all these sources of error and delay are avoided, and the men at each gun receive continuously, instantaneously and automatically a signal of what is to be done, given in a way that entails no noise, and which cannot possibly be misunderstood.

The value of the device comes into especial prominence if we remember that it is absolutely necessary to locate and indicate the position, not only of one, but of several ships. A position indicator should be attached to each group of guns; then these different groups can be concentrated on one ship, or made to fire at different ships according to the judgment of the commanding officer.

Referring to Fig. 2, *A B* represent a line of the parapet of a fort or other defensive work. *C*, *D* and *E* are guns located in the fort and commanding the area which includes the position of the target *F*. The object to be attained is to lay all of the guns, *C*, *D*, *E*, correctly upon the target, although the persons in charge of the guns may be unable to see the target and be ignorant of its bearing and distance. For purposes of clearness, in the following description we shall refer only to the necessary operations con-

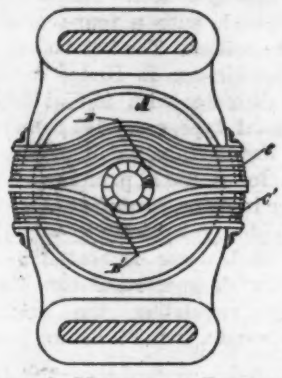


FIG. 2.—HEYMANN'S METHOD OF DYNAMO REGULATION.

nected with one gun, as *E*, premising that the same method is followed in connection with every other gun.

G and *H* are two arcs of conducting material placed symmetrically with respect to a base-line *I J*. These arcs are located at stations distant from the positions of the guns, and so situated that a view of the area to be protected by the guns will not be cut off from the stations by smoke, points of land or other obstacles. For this reason it is better that elevated positions should be chosen for the stations.

K and *L* are two pivoted telescopes, the free ends of which move over the arcs *G* and *H*, and constantly maintain electrical contact therewith. These telescopes may be directed upon the target *F*, which will, therefore, be at the intersection of the two lines of sight of the telescopes.

Located at a station distant both from the guns and from the positions of the arcs *G H*, and usually at a place safe from the effects of the enemy's fire, there is established another station, which, for convenience, we will call a "directing station," in which is a chart or map, represented by the rectangle *a b c d*. On this chart the line *A' B'* represents the line *A B* of the parapet of the fort, and the points *C' D' E'* correspond to the centres above which the guns *C D E* are laterally turned. The chart *a b c d* represents the area within the range of the guns *C D E* on some definite reduced scale, so that distances taken on the chart represent actual distances. On this chart is drawn a line *I' J'* corresponding to the base line *I J*, and symmetrically disposed with reference to that base line are arcs of conducting material *G' H'*.

K' and *L'* are pivoted arms similar to the arms *K L*, the free ends of which pass over and make constant contact with the arcs *G'* and *H'*. Arc *G'* is similar in form and in electrical resistance per unit length to the arc *G*, and the arc *H'* is likewise similar in the same particular to the arc *H*. Extending from the extremities of the arc *G* to the extremities of the arc *G'* are wires 1 and 2, and extending from the pivoted telescope *K* to the pivoted arm *K'* is a wire 3, which includes a battery. Connected in loop from the wires 1 and 2 by a wire 4 is a galvanometer *M*. It will be evident that the wires 1, 2, 3, 4, the arcs *G G'*, the battery and the gal-

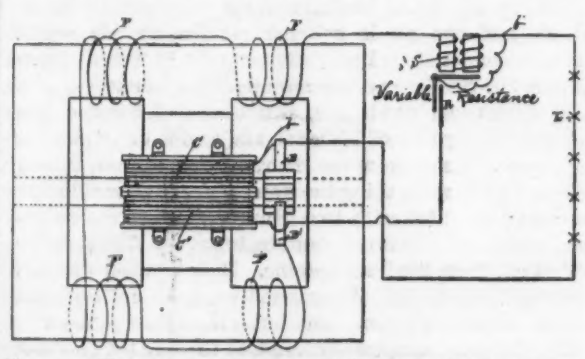


FIG. 1.—HEYMANN'S METHOD OF DYNAMO REGULATION.

vanometer *M* are connected in circuit in the form of a Wheatstone bridge, and that the effect of moving the telescope *K*, for example, to the right on arc *G* is to increase the resistance in the member 1 of the bridge and decrease it in the member 2, and that the same is true of a similar movement of the arm *K'* over the arc *G'*. Therefore if the telescope *K* be set at a certain position on the arc *G*, it is simply necessary to set the arm *K'* to such a position on the arc *G'* as that the galvanometer *M* shall show no deflection, when the bridge will, of course, balance, and therefore the angle made by the arm *K'* to the base line *I' J'* will be equal to the angle made by the telescope *K* to the base-line *I J*. The extremities of the arc *H* are connected to the extremities of the arc *H'* by wires 5 and 6, and the pivots of the telescope *L* and arm *L'* are connected by wire 7, which includes a battery.

M' is a galvanometer included in loop 8 from the wires 5 and 6. It will be seen that this arrangement of the two arcs *H*, *H'* and circuit connections is the same as that of the arcs *G*, *G'* and associated parts, and that therefore when the arm *L'* is placed at the same angle with reference to the base line *I' J'* as the telescope *L* is placed with reference to the base line *I J*, the galvanometer *M'* will show no deflection, and the bridge will balance, as in the preceding case. It follows, therefore, that if the two telescopes *K* and *L* be sighted upon the target *F* by observers located at the telescopes, and if a third observer moves the arms *K'*, *L'* and at the same time watches the galvanometers *M*, *M'*, he will have placed the arms *K'*, *L'* at precisely the same angles as the telescopes *K*, *L* when both galvanometers show zero reading. Inasmuch as the chart *a b c d* bears a definite proportion to the area which includes the position of the target *F*, it follows that if the axes of the arms *K'*, *L'* be prolonged they will intersect at the position *F'*, which would represent on the chart the actual position of the target *F*.

Upon the chart *a b c d* are pivoted three pointers, only one of which, for convenience, is shown at *N*, and these pointers are pivoted at the points *C'*, *D'* and *E'*, which, as already stated, correspond to the centres of horizontal motion or train of the guns *C D E*. Consequently, if the pointer *N* be turned on its pivot, it will correspond to the positions of the gun *E* when that gun is turned on its pivot.

One arm of the pointer *N* is long enough to sweep over the area which includes the target, and it is connected to the intersection of other pointers by a slotted pivot, so that it is automatically made to point in the direction of the target. At the gun itself is an arc *O'* and pointer *B'*, which,

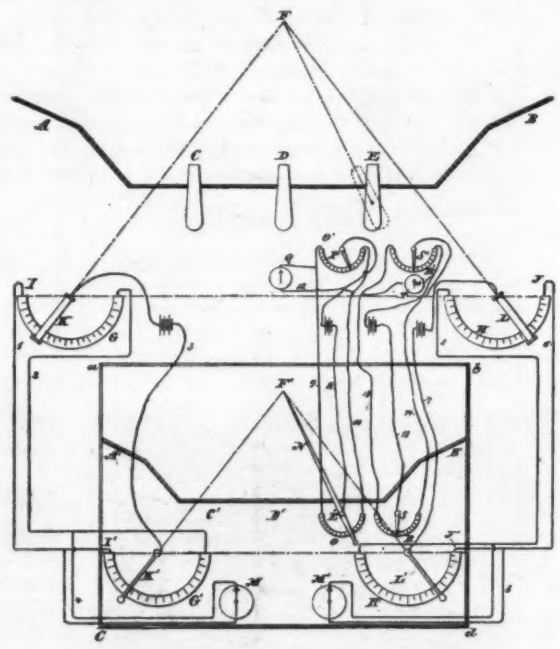


FIG. 2.—LIEUT. FISKE'S POSITION FINDER.

by the principle above explained, always shows how the pointer *N* is pointing. The distance from the pivot *E'* to the intersection of the pointers on the chart is marked on the graduated pointer *N*, and can at once be signaled to the gun *E* by means of the arc *R* and *R'*, according to the same principle.

Or, if desired, the resistance from *E'* to *F'* may at once be signaled automatically according to the same principles. The action of the apparatus is much facilitated, however, if the arcs *P* and *R'* are attached to the gun itself, as shown in Fig. 1, so that the gun itself is moved instead of the pointers, and the man in charge of the training of the gun has simply to watch one galvanometer, while the man in charge of the elevating of the gun watches the other galvanometer. It is evident that both of these men can, by keeping the needles of their galvanometer at zero, keep the gun always properly trained and properly elevated, even while it is being loaded, so that the gun will be ready to fire immediately. It is evident that any number of guns, as *C* and *D*, may be controlled in the same manner, so that the mere automatic action of the apparatus gives to the men at every gun the most simple and accurate instruction possible as to what they are to do, and that no reading of scales is required.

The *raison d'être* of this invention arises from the fact that the modern guns in Europe are tremendously expensive, some costing $100,000; that each shot is terribly effective, and that it costs hundreds of dollars to fire each shot. It is, therefore, absolutely necessary that there should be no delay in firing, and that each shot should hit the enemy.

A Novel Dynamo Regulator.

In a patent recently issued to Edward and Frank W. Heymann, of Boston, the inventors describe a method of dynamo regulation which is based upon controlling the electromotive force in the armature coils by means of a shunt circuit so arranged as to act by induction upon the armature coils, a variable resistance in that shunt circuit being adjusted from time to time to regulate the differences of potential between the terminals of the work circuit.

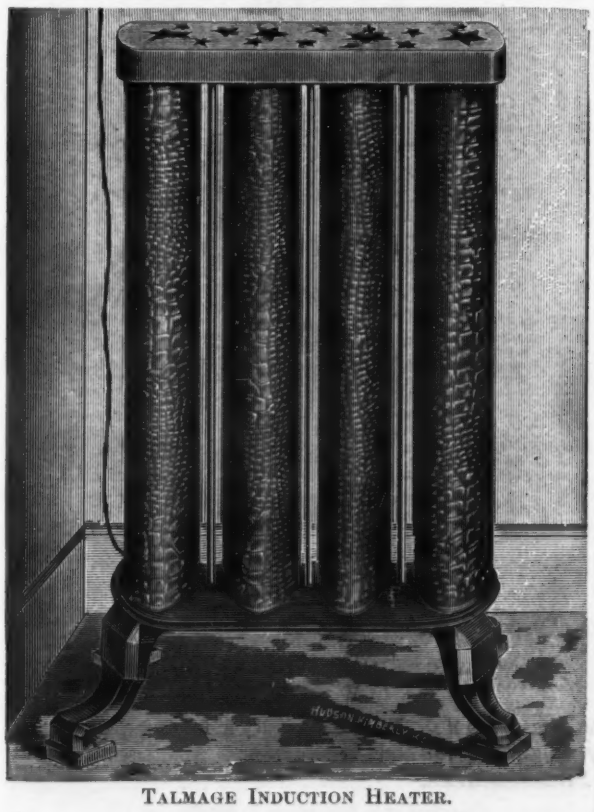
As shown in the accompanying illustrations, the regulating coils $C\ C'$ are in the shunt circuit $b\ C\ C'\ b'$. When at full load, the resistance R is so large that the shunt circuit $b\ C\ C'\ R\ b'$ is practically open, so that there is little or no current in that shunt circuit. If one of the lamps L be switched out, the current in the work circuit $B\ L\ F\ F\ B'$ will tend to increase; but if the resistance R in the shunt circuit be reduced, the current in the work circuit will be thereby kept constant, for the reason that the current through coils $C\ C'$ will so reduce the electromotive force of the armature coils as to make the difference of potential between the brushes $B\ B'$ suitable for giving the desired current in the work circuit. Consequently, if the resistance R be reduced whenever the resistance in the work circuit is reduced, and in the proper proportion, the current in the work circuit $B\ L\ F\ F\ B'$ can be maintained constant, and this with proper economy for practical purposes.

In the case already described the difference of potential between the brushes $B\ B'$ or between the junctions $b\ b'$ requires to be varied in order to keep the current constant in spite of variations in the resistance of the load; but in case of a constant-potential machine the object is to keep the difference of potential between the brushes $B\ B'$ constant, whatever the resistance of the load, and consequently the current may vary. In this case, under full load, the resistance R in the shunt circuit $b\ C\ C'\ R\ b'$ is at the maximum, as before; but when one lamp is cut out the resistance of the load is thereby increased, and the tendency is, in that case, to increase the difference of potential between the brushes $B\ B'$; but that difference of potential can be maintained constant by decreasing the resistance R as the resistance of the load is increased.

It will be seen that the shunt circuit $b\ C\ C'\ R\ b$ is not a mere shunt—that is, as if the regulating coils $C\ C'$ were not present—for if the coils $C\ C'$ were absent the current through $b\ R\ b'$ would be considerably more than it ever would be through $b\ C\ C'\ R\ b'$. That is to say, the coils $C\ C'$ regulate the electromotive force of the coils of the armature and also set up a counter electromotive force, which not only lessens the current through $b\ C\ C'\ R\ b'$, but also regulates the difference of potential between the brushes $B\ B'$.

The Talmage Electric Heater.

One of the most interesting of the exhibits at the late convention of the National Electric Light Association was the Talmage electric induction heater, which we illustrate in the accompanying engraving. It is an induction coil



TALMAGE INDUCTION HEATER.

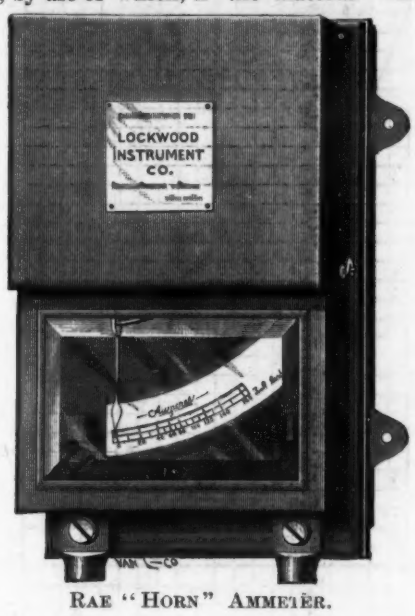
built in the shape of an ordinary steam or hot water radiator. It is not in the nature of a resistance box, as some other forms of electric heaters, but, on the contrary, every bit of resistance that could possibly be avoided has been eliminated.

The heater is constructed with a laminated magnet for a core, around which is wound the primary coil in one or more sections of sufficient sized wire to carry the primary current without heating; and around that is wrapped one turn of very thin sheet metal, which constitutes the conductor for the secondary or induced current. This secondary circuit is closed upon itself, or short circuited, all the energy being spent in heating the conductor itself, which, being very thin and very wide, has a maximum radiating surface in proportion to its cross section, and thus immediately radiates the heat produced in it by the generation of the large volume of current.

It will be seen from the construction of the heater that the length of the secondary circuit is exceedingly short, and thus an exceedingly small E. M. F. in the secondary circuit carries an enormous volume of current around the circuit.

The heaters on exhibition at the late convention took in their primary coils a current of five and six ampères, respectively, with an E. M. F. of 100 volts, and this was transformed to one of only .0017 volt and from 2,300 to 3,000 ampères. The energy which in every converter or transformer is lost in heating the iron core is not lost in this case, as it is the heat which is wanted, and the radiator radiates the heat from this source, as well as that produced by the secondary current.

Mr. Talmage claims to have an improvement already in course of construction, but which could not be completed in time for the convention, by which he gets a secondary conductor of one-fifth the thickness of that used in those exhibited, by use of which, if the material were of the



RAE "HORN" AMMETER.

same electrical resistance, he would obtain the same temperature with one-fifth of the current now employed, because the surface is the same, while the cross section is reduced five times. The resistance evidently would be five times as great in the thinner conductor if the same material were used. But in addition to getting this much thinner conductor, and thus saving four-fifths of the energy expended in those on exhibition, he proposes to use a conductor of nearly four times the conductivity, and thus to effect a further saving by being able to reduce the E. M. F. as well as the current volume. The two combined, will, he claims, enable him to heat about eight times the surface with one-half the energy consumed in heating those on exhibition.

The inventor lays stress upon the facility of distribution afforded by these heaters, and on the fact that they are specially adapted to the alternating current. A thermostatic switch is used with them, thus assuring a uniform temperature in the room, the thermostat being adjusted as desired to break circuit at any desired degree of heat.

The advantages of electric heating over other methods from the point of convenience are so numerous and obvious that it is hardly necessary to mention them; but probably the greatest one is the abatement of the smoke nuisance, there being no dust or dirt at all, as all the coal can be burned in one central station.

The Rae "Horn" Amperemeter.

In electric measuring instruments it is of first importance that the controlling force should not be liable to changes, due to variations of temperature, position, etc., and it is well known that no controlling force is so suitable in this respect as that of gravity. The most serious objection to its adoption, however, has been the difficulty in making the deflecting force increase proportionally with that exerted by gravity, which increases rapidly as the pointer and armature leave their vertical or zero position. It is therefore evident that, in order to obtain a uniform scale, the force exerted by the current to be measured must keep pace with the increasing action of gravity. This can be accomplished in either of two ways, or by a combination of both. In the first, the armature is so situated or shaped as to move into an increasing field of force due to its situation or shape in relation to such field; in the second, by suitably proportioning the mass of iron to the magnetizing current, the magnetization being made to increase more rapidly than the current.

A brief description of the instrument invented by Mr. Frank B. Rae, of Detroit, will show that he accomplishes the above by a combination of these conditions. In this instrument he has a tapered, well annealed iron core of relatively large dimensions, bent so as to be concentric with the arc of swing of the armature. The upper portion of this tapered "horn" is wound with wire to carry the current to be measured; the lower portion protrudes from the windings and tapers down to a cross section considerably less than that enclosed by the helix. To the upper pole of the horn and against the cheek of the windings is fixed a bearing, also of soft iron, from which is freely suspended a rod of iron, attached at its lower end to an iron ring, the inside diameter of which is such as to allow it to have about one-eighth inch clearance when at the largest part of the horn. To the lower edge of this ring is fastened rigidly a light pointer, which passes in front of a scale, upon which are marked the values of the current in ampères. When this ring armature is in its zero position it hangs vertically and just incloses the tips of the "horn."

It will be readily understood that on the passage of a current a certain degree of magnetization is imparted to the tapered horn, so that a pole is formed at its end opposing the ring where an opposite pole is induced, since there is a complete magnetic circuit, broken only by the space between the ring and the tips of the horn. The ring will be deflected and tend to creep up the horn in order to shorten the magnetic circuit. This it does until the magnetizing force is balanced by the pull of gravity.

These instruments possess several important features; thus, they are practically dead beat, are reliably and strongly made, and not liable to derangement. They are manufactured in sizes reading from 60 ampères to 400 ampères. The instruments are inclosed in hardwood cases, with beveled glass fronts, and all metal parts are highly polished and handsomely plated. The Lockwood Instrument Company, of Detroit, are putting this instrument on the market. The annexed engraving shows the instrument in perspective.

The "Central" Spark Arrester.

The accompanying cuts, Figs. 1 and 2, illustrate a device to keep sparks from dropping from arc lamps. Complaint has frequently been made that sparks have fallen and damaged or destroyed goods over which the lamp was suspended; and in many cases the use of arc lamps for indoor lighting has been discontinued by reason of this danger The Central spark arrester rests upon the top of the globe and reaches up to and around the cylinder of the lamp, inclosing all the intervening space, and absolutely prevents the escape of the heated particles of carbon. It is made to fit any inside frame lamp, and all outside frame lamps where the cylinder is suspended from the inside of the top of the frame. Fig. 2 shows the arrester removed while the lamp is being trimmed. Fig. 1 shows the arrester in position upon the lamp. A rubber flange or apron fits tightly around the top of the globe, and the body of the arrester being of wire cloth, there is a free escape

FIGS. 1 AND 2.—CENTRAL SPARK ARRESTER.

for the heat. This device is being introduced by the Central Electric Company, Chicago.

Polarity and Consumption of Arc Light Carbons.

To the Editors of The Electrical World:

By answering the following you will greatly oblige a subscriber: 1. A says that the top and bottom carbons of one side of the electric arc lamp are positive, and that the top and bottom carbons of the other side of the lamp are negative; while B says that the two top or long carbons are positive, and the two bottom or short carbons are negative. 2. A also says that the consumption of both the top and bottom carbons is equal in the direct system of lighting; while B says that that is only the case in the alternating system; but that in the direct system there is decidedly much greater consumption of the upper carbons than of the lower carbons.

NEW YORK CITY. X.

[ANSWER: If reference is made to the double arc lamps in general use to-day, B is right. 2. B is also right on both points.—EDS. E. W.]

Olmsted Hand Dynamo.

We illustrate below a new form of experimental dynamo, strongly built, for the use in colleges and other places where apparatus of this character is required. It will generate one-ninth of a horse power of current. It consists of field magnets *A A*, mounted upon a polished double base *B*. These are accurately balanced with a Gramme armature *C*, which is made to revolve in brass journals *D*. The pole pieces *E* of the field magnet protrude downward and embrace the armature through the proper number of degrees of the circumference of the armature. The commutator *F*, to which the coils of the armature are attached, is constructed and proportioned to the heaviest currents that will ever be required to be produced by the machine. The commutator brushes *G* are thoroughly insulated from the frame, and the terminals *H H* are placed in connection with these brushes, one around by the way of the field magnets, the other direct. The connections throughout are of such a nature that they may be easily traced before a class for purposes of explanation, as the generator has been mathematically and scientifically designed for this purpose.

The power is transmitted from a large and solidly constructed hand-wheel *I*, by means of a rope transmission. the strain being divided up among several cords *J*, instead of depending upon one, and an automatic tightening device in the rear of the machine forms a useful addition which keeps all the strands of equal tension and makes each one do its portion of the work of driving the arma, ture.

The machine is placed on the market by W. A. Olmsted, Chicago.

The Olmsted Hand Dynamo.

Recalescence.

BY ROBERT SHAND.

At the meeting of the London Institution of Electrical Engineers, on January 9 last, Sir William Thomson, after reviewing some of the facts and theories advanced by Dr. J. Hopkinson in the course of his inaugural address as president of the Institution, on the subject of "Magnetism," referred to the immense importance of recalescence phenomena, suggesting further investigation at temperatures a little above and a little below the critical one, and remarked that "if the effect described is reversible, then the material should cool while heat is being supplied to it."

Something less than a year ago, a somewhat brief experimental investigation of the subject was made by Prof. Elihu Thomson, and, I believe, the results obtained, he embodied in a paper which appeared in the columns of this journal. New phenomena were then observed which meet to a considerable extent the suggestions of Sir William Thomson. I will state my recollections on the subject.

While engaged in the early development of his now well known method of welding by electricity, the attention of Prof. Thomson was strongly arrested by the magnitude of the recalescence phenomenon; it was then frequently pointed out by him, and the investigation above referred to was subsequently undertaken with the view of determining some of the changes undergone by the material at temperatures around the critical one at which the effect showed itself. The results of the investigation can be stated quite briefly, as follows:

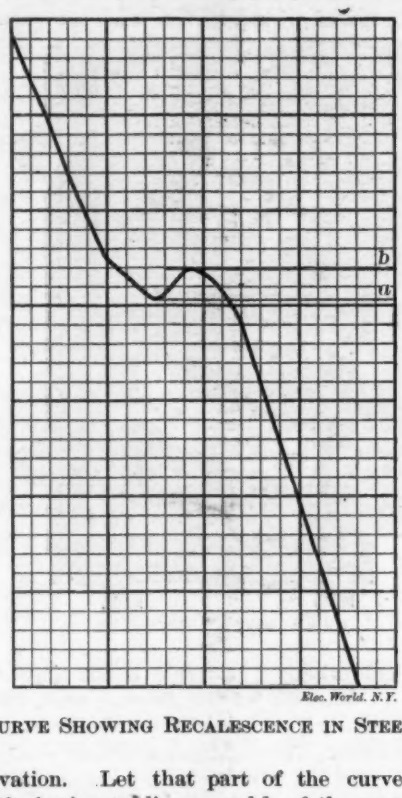
(1) The temperature of decalesence and the quantity of heat rendered latent during the heating of the material was found, within the range of observation, to bear a certain definite relation to its hardness, presumably to the percentage of combined carbon contained in it.

The hardest specimen of steel submitted to observation possessed the highest critical temperature, and recalesced with most vigor. Softer specimens of steel tested under the same conditions showed recalescence waves less in magnitude and occurring at lower temperatures. With soft iron bars the effect was not observed.

(2) The temperature of decalescence. *i. e.*, the critical temperature at which the material *cooled* while heat was being supplied to it, was higher than the temperature of recalescence during cooling.

(3) Heating the material from a point a little below, to one a little above, the critical temperature, and vibrating the temperature thus many times in succession, seemed to induce in the material a condition of exhaustion; at any rate, the magnitude of the phenomenon was lessened by such treatment. Allowing the material to cool off, or raising the temperature considerably above the critical point, restored to the material the power of vigorous recalescence.

(4) With the view of locating approximately the point in the temperature curve at which the resumption of magnetic qualities began, a hard steel bar was submitted to observation. Let that part of the curve included between the horizontal lines *a* and *b*, of the accompanying diagram, represent the wave of recalescence due to the liberation of latent heat. After the crest of the wave passes, and just as the temperature curve passes the *a* line (at which level the wave had commenced), the restoration of the magnetic capacity of the bar is commenced.



Curve Showing Recalescence in Steel.

It would be exceedingly interesting in this relation to ascertain by measurements. closer than were possible with the apparatus constructed by Professor Thomson, whether or not it is possible that the same piece of steel, at the same temperature before and after recalescence, can exist in two different states as regards its capacity for magnetization?

Alleged Infringement of Edison "Motor" Meter.

A bill of complaint was filed on Tuesday last in the U. S. Circuit Court. Southern District of New York, by the Edison Electric Light Company, against the United States Illuminating Company of this city, now controlled by the Westinghouse Electric Company, of Pittsburgh, for infringement of what is known as Edison's fundamental electromotor meter patent No. 242,901. This was applied for March 3, 1881, and issued June 14 of the same year. It occupies a prominent position in a field which was considered by Mr. Edison very early in the art to be of great importance, and reference was made to it in the issue of The Electrical World of Jan. 5, 1889.

The specification sets forth the fundamental principle of this class of measuring devices to be the combination of a motor, actuated by the whole or a part of the current to be measured, with a definite amount of work to do or resistance to motion to be overcome, and registering devices. One paragraph of the specification shows the theory of the action very clearly:

"I have found that the rapidity with which the motor will accomplish its work with a definite loading is proportioned to the amount of current energizing it. Hence, if the motor be arranged to have a slow motion when the amount of current necessary for, say, one translating device, passes through the circuit, its speed will be increased proportionately as the number of translating devices using current is increased."

Its claims are so comprehensive, and relate so specifically to the vital features of the commercial apparatus since constructed by several companies, that the exact language will be of interest:

1. "The combination, with an electric circuit containing translating devices, of an electric motor having a definite loading and apparatus for registering the work done, substantially as set forth."

2. "The combination of an electric circuit, an electromotor, a fan driven thereby, and a registering apparatus, substantially as set forth."

3. "The combination of an electric circuit, an electromotor, a fan or blades driven thereby, a vessel or tank in which the fan or blades are placed, and registering apparatus, substantially as set forth."

4. "The combination of an electric circuit, an electromotor, a fan or blades, a vessel or tank filled with liquid, in which the blades or fan are placed, and registering apparatus, substantially as set forth."

5. "An electric meter consisting of a motor having a definite work to perform or loading to overcome, and registering devices, substantially as set forth."

It is alleged that the Shallenberger meter, of which a large number have been put into use the past year, infringes this patent, and that Mr. Edison's early working models, by which, it is claimed, good results were obtained nine years ago, are still in existence and plainly show the reduction of the principle to practice. The motor meter would, it is also claimed, probably have been adopted as the basis of selling current in Edison central stations, had not the chemical meter been shown or considered, after test, to be the more accurate and cheap. The alternating current has never been measured by chemical meters.

The litigation is evidently one of great interest and importance.

The "Razzle Dazzle" Lightning Protector.

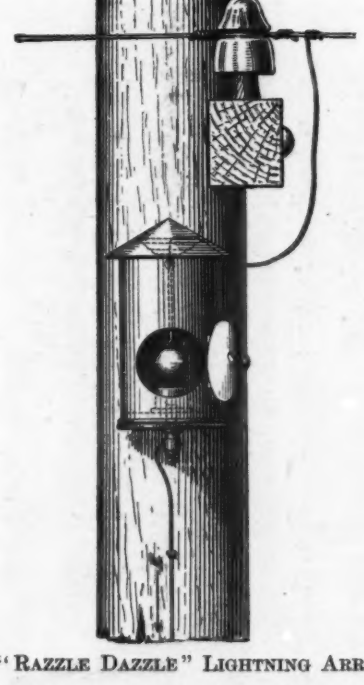
Lightning arresters are considered a necessary adjunct for the protection of the dynamos and other machinery in electric central stations, and a large number of types of apparatus have in the past been designed for this purpose. Among the more recent ones possessing some novel and interesting features is that known as the "Razzle Dazzle." As shown in the accompanying engraving, it consists of a swinging metallic ball suspended above, and as close as possible to, a ground plate or table. The lightning in passing to earth jumps from the ball to the plate, causing the ball to swing, and thus prevents the fusing of the metal or injury to the protector; at the same time the formation of a permanent ground cannot take place. The apparatus is so simple, cheap and effective, that it can be used liberally on the poles of telegraph, telephone, electric light, electric railways, etc., and by a neat attachment it can be made to answer for a number of wires. Mr. Henry W. Pope, of Elizabeth, N. J., is the sole agent for the protector.

The Greeley Small Motor.

To the Editors of The Electrical World:

In describing the Kortheuer electric launch "Edison" in the columns of The Electrical World, you mention the Greeley motor. Will you kindly in form me where and by whom they are manufactured? J. C. H.

Pittsburgh, Pa.



The "Razzle Dazzle" Lightning Arrester.

[Answer: The motor in question is made by The E. S. Greeley & Co., of 5 and 7 Dey Street, New York.—Eds. E. W.]

Velocity of Electricity.

To the Editors of The Electrical World:

1. Please inform me through the columns of The Electrical World how long it will takethe current to travel a copper metallic circuit of thirty miles with fifty 1,200 c. p. arc lights in circuit?

2. Also say what will be the difference in time between the forming of the arc in the lamp nearest the positive brush and the one nearest the negative brush in the above circuit. C. H. Dame.

Dover, N. H.

[Answer: 1. Taking the velocity of electricity at 192,000 miles per second, the time occupied would be about $\frac{1}{6400}$ part of a second. The electro magnets in circuit, however, would act to lengthen the time somewhat. The transmission would be practically instantaneous.

2. If the lamps were all adjusted alike, and current were assumed to start at the positive brush and pass to the negative, a simple calculation will give the intervals. Practically the arcs would be struck simultaneously in all lamps. —Eds. E. W.]

Patent Law, and What Constitutes an Invention.*

BY GROSVENOR P. LOWREY.

Before considering for what a patent will be granted and maintained, it will, I think, be interesting to glance at the history of this way of encouraging inentors. I do not say of rewarding them, though that phrase is often used by higher authorities. We do not predicate reward of a system by which we compel a man to part with some part of what he has in possession, and of which he might keep the whole. Besides, no design to benefit the inventor or recognize him as possessing a right appears in any English or American statute. It is a public object always which the State has in view in promoting legislation on the subject, and the private gain is only so much sacrificed to obtain more.

In a case decided in the reign of Edward III., it is said that arts and sciences, being greatly for the public good, are favored in law, and that the King, as a guardian of the public weal, has power to grant privileges for the sake of the public good.

The same principle is implied in the constitutional provision under which our patent act has authority. It is there provided that Congress shall pass laws to promote the progress of science and the useful arts by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries. The promotion of science and the useful arts in general is, of course, a public end. The advancement of this public end is the primary purpose, and the advancement of private interests is the secondary and incidental purpose of our patent legislation. The method of advancing the public end is to give to the inventor for definite times the exclusive use of his invention, on condition that he will so describe it that it may be freely published after this time. The relation between the inventor and the State is one of selfish contract purely.

Patents covering monopolies of certain industries or arts had their rise long prior to the reign of James I., and were always petitioned for and received as a matter of grace and favor, and not of right.

Patent law to be found in the statute is but a limited part of patent law. It is chiefly judge-made law, and is found in numerous volumes devoted to reports of cases which the statute does not, and which no statute ever could, determine.

So in considering the history of a growing system of laws inimately related to the industrial development of our race, the early stages of that growth may be easily seen and described. But when we reach the year 1790, and the passage of the first United States Patent Act, the subject seems to take a plunge like Niagara, and afterwards to spread itself over vast levels, whose shores cannot be seen. Most members of this club know in a general way all the provisions of our patent acts, and a résumé of these provisions could only be in the nature of an inventory, paraphrasing the simple language of the law itself. The discussion of particular questions is what you would like to hear, possibly, but when we speak of particular questions, we must first consider what it is which makes them particular. It is always something in the facts of the particular case which breeds particular questions of law. Intelligent discussion of any particular question which you might have in your minds, is impossible, therefore, unless the facts on which the questions arise be known. And even then such prejudicial discussions are of slight value, the law not being an exact science, on account of which we may be sure to find its professors differing in every case—one on each side. Their difference will scarcely ever be about what the law in the abstract is, but what is the law of the particular facts in controversy, and Mr. Lincoln was accustomed to distinguish judges from other lawyers on the sole ground that the judges have the last guess.

I shall now draw in from the broad topic, Patent Law, which your committee proposed to me, and restrict myself to two topics of that wide subject: (1) What constitutes an invention—which was also specially suggested to me; and (2) what is the true term of a patent for an invention previously patented abroad? These questions arise under Secs. 4,886 and 4,887 of the Revised Statutes, and, therefore, when the first question is disposed of, it is not a long step to where the other lies hidden in a mystery—awful to the interested parties—which may be lifted by the Supreme Court, next Monday.

In respect of the first topic, a limitation must be proposed to bring it within my capacity to understand; we must restrict ourselves to considering what is a patentable invention, under the statute as it stands. Outside of that prosaic limitation, the question is one of psychology, and could not be, What constitutes a patentable invention? but, What is invention in itself? Here would be an unlimited field, for the cultivation of which I have no competency. In respect of that, I shall have to repeat what was said by one of the numerous claimants of the inventorship of the telephone when pressed to explain the principles on which his great invention operated. He said: "Look a-here, Mr. Storrow, I'm no professor; I'm just a practical man." Being just a practical man myself, I can do nothing with speculations whether invention is distinguished from other lesser mental operations by the constant element of imagination. I have been present at the ostensible birth of one great invention, and though it came like a flash across the sky, it was a work of pure reason. This was the phonograph of Mr. Edison. Sir William Thomson said of the telephone that it realized a mathematical conception, and a mathematical conception has but little imagination in it; and the late Mr. Dickerson was in the habit of arguing that Bell, once in the eddy and vortex of his own special knowledge, was swept by a resistless logic to think of the magneto-telephone, and of the principle of the famous fifth claim, whether he would or not.

Nor will time permit me to distinguish experiment and inchoate conceptions from invention reduced to practice. Questions of that sort can arise, I think, only between rival inventors, in that scramble for a patent which is dignified as "the race of diligence."

The little I have to say must be within the adjudicated definitions of the courts, and relate only to inventions for which patents have already been granted.

Every invention or discovery of (1) a new or useful art; (2) machine; (3) manufacture or composition of matter; (4) or any new and useful improvement thereof, is patentable, except such as have been (1) known or used by others in this country previous to the date of the invention; (2) or patented or described in any printed publication in this or any other country; (3) or on sale or in public use for more than two years prior to the application for patent; (4) or which can be proved to have been abandoned.

There is a mere paraphrasing of the statute, it is true; but we must begin somewhere. So let it be with a defined, practical idea of invention, made in view of its place in patent law usage rather than in philosophy; in other words, "patentable invention."

I will quote the language of the Supreme Court in a case where they held a certain improvement in revenue stamps not patentable.

"As soon as the mischief became apparent, and the remedy was seriously and systematically sought, the present regulation was suggested and adopted, just as a skilled mechanic, witnessing the performance of a machine, by the application of his common knowledge and experience, perceives the reason of the failure and supplies what was obviously wanting. It is but the display of the expected skill of the calling, and involves only the exercise of the ordinary faculties of reasoning upon the material supplied by a special knowledge, and the faculty of manipulation which results from its habitual and intelligent practice, and is in no sense the creative work of that inventive faculty which it is the purpose of the Constitution and the patent laws to encourage and reward." (Hess v. Reynolds, 113 U. S., 73.)

In the same case the court said, denying the patentable quality of the device:

"It does not spring from that intuitive faculty of the mind put forth in the search for new results or new methods, creating what had not before existed, or what had been hidden from vision."

First, the invention must relate to one of the enumerated subjects (for not all inventions are patentable), and must meet the affirmative conditions by being new and useful. With all this it may fail of obtaining or supporting a patent if the negative conditions of being previously unknown in this country, etc., are not complied with.

It must have emerged from the shadowy region of mental gestation, and be capable of such description that one skilled in the art can make or practice it from that description; it must have been born legitimately among the royal progeny of inventive thought, not among the brood of good things and notions which hourly spring from the practice of every trade and art. Yet these are merely words, and do not help to make vital distinctions. It is easy to see what is not invention, but no infallible rule is known to me by which to ascertain what is an act of invention, as distinguished from a work of mechanical skill. That is often born in a manger which is destined to rule the fortunes of mankind—and of all great agencies of this sort the industrial invention has most frequently this humble origin—and it has no mark. Only judicial inquiry in the Patent Office or the courts can certify it by setting a seal upon it.

And then its title is not clear until it has won the last seal. For instance, I can venture to assure this Club that contrary to the opinion of counsel on both sides of the question—indeed, there was no question—it is not an act of invention to improve a cabinet creamery in which cans of milk are set by letting the lower half of the can protrude through the bottom of the box and surrounding the upper part with water, as a method of cooling the top of the milk and inducing it to rise and fall in reverse vertical currents, depositing its cream at the top. No experts were asked whether the state of the art precluded the idea of useful novelty in this device. The lawyers made no question that there was invention, and disputed only who it belonged to. Weeks must have been spent in taking proofs on this point. And, finally, out of its inner consciousness, apparently, perhaps of its own lacteal experiences (including the morning coffee compound where it would be nonsense not to have the milk hot), the court determined that there was nothing new and useful in this method of making it cool.

I mention this because it is the last case on the point, and because it is the only one known to me in which both sides were defeated.

True inventions have been recognized judicially in terms of such general import and application that when they have received sufficient application they may suffice to found some general definition by which a true invention may always be known. I will repeat a few of these, selected without system.

An invention will always produce a new result (93 U. S. 486), or an old result in a new way or an improved way (9 F. R. 239). The better use of known equivalents does not involve invention (103 U. S. 797). It must be useful; but a small degree of utility will suffice if the novelty is clear, and a great degree of utility will float an invention in which the novelty is slight—that is, in which the new part is but a small proportion of the whole, or is but a slight departure from what was known before. There must be more than the mere skill of the mechanic or the use of better materials in it; and as the skill of mechanics is increasing, so does the degree of the intellectual element of invention require to sustain a patent increase (102 U. S., 112; 112 idem, 244; 31 F. R., 224). An accidental making of a thing, without the power to reproduce it, is neither invention nor discovery, in the legal sense (1 B. & A. 599). To make a machine of iron which has been made of wood with the sole result of improving its strength and durability is not invention; but if, being of iron, the machine should by that fact have a new application, or should give a superior product, it would be patentable for that new use at least (3 Fish, 103). To render an article salable which was before unsalable, is some evidence of invention (17 Black, 249). The term as used in law, implies an operation of the mind, resulting in finding out or devising something useful which did not exist before (1 Fish, 252). The last serial number of the United states Supreme Court reports contains a decision on a patent for a device for opening or closing simutaneously both gates of railway car platforms, consisting of links connecting the gates with rods sliding in or on bearings secured to the guard rails of the platforms, and having handles whereby the attendant standing at the end of such guard rails may open or close the gates. I choose this as an example, first, because it is the very latest case on the subject, and next because the infringer being the Manhattan Railway Company, every member of the Club can have the opportunity, for five cents, by standing on a crowded platform, to study the case of a non-invention every night and morning. The Supreme Court complimented Judge Wallace, of this circuit, by copying a considerable part of his opinion and adopting it. The principles which he laid down will give the cue to define sometimes, the line between invention and mechanical skill. He said: "A brief reference to the prior state of the art will indicate that the combinations referred to in the several claims are merely an application to a new situation of old devices which have been previously applied to analogous uses. This partial exhibit of the prior state of the art demonstrates that what the patentee did was to adapt well-known devices to the special purpose to which he contemplated their application. It was necessary that the gate should swing inward to open, and outward to close; that the sliding rod should be located where it would be out of the way of passengers entering or leaving the platform; and that the end or handle of the rod should be located where it could be conveniently operated by the attendant without inconveniencing outgoing or incoming passengers. The new situation required adequate modifications of existing devices for opening and closing an aperture at a distance from the operator, appropriate to the new occasion. Accordingly, the patentee located the rods on bearings secured to the guard rails, with their handles near the passage way formed by the space or opening near the middle of the guard rail. If this required invention, his improvement was the proper subject of a patent. He did nothing more and nothing less than this. It seems impossible to doubt that any competent mechanic familiar with devices well known in the state of the art, could have done this readily and successfully upon the mere suggestion of the purpose which it was desirable to effect. The patentee is entitled to the merit of being the first to conceive of the convenience and utility of a gate-opening and closing mechanism which could be operated efficiently by an attendant in the new situation. His right to a patent, however, must rest upon the novelty of the means he contrives to carry his idea into practical application. It rarely happens that old instrumentalities are so perfectly adapted for a use for which they were not originally intended, as not to require any alteration or modification. If these changes involve only the exercise of ordinary mechanical skill, they do not sanction the patent, and in most of the adjudged cases, where it has been held that the application of old devices to a new use was not patentable, there were changes of form, proportion or organization of this character, which were necessary to accomodate them to the new occasion. The present case falls within this category."

A leading case (Penn. RR. vs. Locomotive Truck Company, 110 U. S., 490), holds that the application of an old process or machine to a similar or analogous subject, with no change in the manner of applying it, and no result substantially distinct in its nature, will not sustain a patent, even if the new form of result has not before been contemplated. Under that authority it has been held that a mechanical combination for turning skewers or spindles in wood, anticipates a similar combination for cutting sewing machine needles. The application of the combination to one material naturally suggested its application to the other material, and its being a mere mechanical adaptation, which is not patentable (94 U. S., 187, and 107 U. S. 192). Other practical applications which have been held not patentable have been: Means for applying steam power to capstans (112 U. S., 224); applicatory to a valve for water cylinders for steam engines (114 U. S., 679); for improvements in street cars (114 U. S., 149); for cheese formers for cider presses (119 U. S., 135); for tools for attaching sheet metal moldings (139 U. S., 130); for vehicles, dashes and dash frames (29 U. S., 142); and, lastly, the railway car gates already spoken of.

The best reflection which I have been able to give to the problem, "What is invention?" seems to leave the question for further psychological study, and I doubt if any mere lawyer will ever find it out. It is for a philosopher, and when he propounds the answer, who will understand him? Who shall explain his explanation? I do not refer to that question arising between inventors: "When does an invention pass from the inchoate state of speculation and experiment, and become a full-fledged invention?" That would open another field which there is not time for.

The condition of usefulness, as a prerequisite of a patent, is complied with, if the article is useful at all; that is, degrees of usefulness will not be inquired into. That which is mischievous or immoral cannot be useful in a patent sense; and, therefore, a patent would be denied to the most novel and ingenious way of setting fire to houses or robbing banks. The new and useful invention must, however, relate to an art or a machine, manufacture or composition of matter, or an improvement on one or more of these.

An art, in this sense, is a useful way of doing things, which, when done, are useful. This naturally includes all processes. A new method or process of doing useful things, old or new, is patentable as a process. Process has been defined as a mental conception capable of being carried out by any means, new or old, and if the process is new and useful, it is patentable though the product and all the means are old. A leading case on process in this country is Tighlman vs. Proctor, which case should encourage every beaten inventor and his counsel never to say die, even when certainly dead.

Another is the telephone cases. The Bell patent of 1876 was enforced against infringers, not because they used any device which he had ever thought of, but because the principle or process on which the inculpated device worked, was that on which another device, not in use, and invented by the patentee, was assumed to work. That process being claimed and held to be new—the fact that the apparatus by which alone the patentee had any idea of using it was impracticable, *i. e.*, not useful outside of an experimental laboratory, did not prevent the court from restraining the use of other and practicable machines, not invented by Professor Bell. The inventions of Blake, Berliner and Edison, which constitute the telephone transmitter in universal use, could none of them have been used except under license of the owner of Bell's patent, and his impracticable figure 7; and yet he never made a transmitter capable of commercial use.

In the telephone cases reported in 126 U. S., a rule was asked for (page 204) by which to determine when an art is discovered. Having in view certain facts which were assumed and asserted, and believed in respect to the previous experiments of Philip Reis, it became the duty of counsel to urge as a proper answer that:

To conceive that a thing can be done;

To indicate correctly the general laws of nature which must be availed of;

To create suitable apparatus, even though it is suitable in a very limited degree only;

To use the apparatus and succeed, though only in a limited degree;

To publish the result with sufficient specification to reveal the whole purpose and to put the world on further inquiry;

Is it a sufficient discovery to take the doing of that special thing out of the category of wholly undiscovered arts, and to defeat broad claims by subsequent inventors of mere apparatus?

From that state in the development of that art, I urged conscientiously that invention and discovery must be limited to the perfecting of old or the invention of new mechanism, by which to practice the previously discovered art. The court did not think the facts of the case supported by hypothesis, and the reasoning, therefore, did not prevail; but this does not impeach its correctness, considered abstractly or in relation to any simple basis of fact. I should say, therefore, notwithstanding the decision in the telephone cases, that a new art may be sufficiently discovered independently of any good mechanism for practicing it, to defeat from that time the allowance of broad claims for any process to the subsequent maker of good apparatus.

The word "machine" includes every mechanical device or combination thereof, or of mechanical powers and devices to perform work. It is said there can be no patent for a mode of operation exhibited by a machine; but this must mean where the mode of operation results from the machine, and not where the machine is contrived to carry out a process previously conceived, especially if various constructions are adaptable to operate the process. A process is said to be a mode of treating materials to produce a given result, and the machinery pointed out as suitable to perform the process, may or may not be new and patentable. Of course every process which depends on a machine, is in a sense the function of that machine; as, on the other hand, every machine is an embodied function of some sort. I think a short way for determining the patentability of claims for such processes might be to inquire the object of the inventor and the progress of his idea; did he make a machine and stumble on its functions, or did he conceive a function and labor to devise a machine capable to execute it. In the one case he begins with a conception of the mind and proceeds to a work of the hands; in the other he perfects a work, and then, watching to see what it will do, claims its functions as a process, in order to prevent, by a broad claim, other men from making different machines to attain the same object. Mechanical processes, are, therefore, held to be not patentable, being merely the inevitable way the thing works. There does not seem to be any infallible or universal rule for distinguishing those purely mechanical processes, born from a machine rather than from the brain of its inventor, from those other functional processes, which, together with their connected apparatus, is held to be patentable. It appears to me, however, that the unpatentable process will most generally be the final thing resulting from the machine's operation; and that the patentable process will be found to be an intermediate function to produce a final process. Thus we say "that a board is undergoing the process of being planed, or grain of being ground, or iron of being hammered or rolled." (Corning vs. Burden, 15 How., 268.) Here the term is used passively or subjectively, as applied to the material operated upon, and not to the method or mode of producing that operation, which is by mechanical means as distinguished from a process. In this use of the term, said the court in Corning vs. Burden, it represents the function of the machine. That function, for instance, grinding grain, is non-patentable. But the case of the Bell telephone is clearly different. There a process was held patentable, but, upon examination, we find that it was an intermediate process, which was not the function of a machine, but which has itself a function which is the final object of the whole operation; to wit, the reproduction in one place of sounds made at another place. The machine is composed of the transmitting and receiving mechanisms, the batteries, and the connecting wire. The first, and patentable process, is the creation of electrical undulations of current strength on the wire, similar in form to air vibrations, accompanying and constituting sound. The secondary process is the reproduction of those sounds. No court would sustain a simple claim for the transmission or reproduction of sounds telegraphically, which is the final process. But they have, thus far, unanimously sustained the claim for that process when carried on by the primary process of "causing electrical undulations similar in form to the vibrations of the air accompanying the sound."

It was not my intention to make any reference to proceedings in the Patent Office, having no special familiarity with them, and the subject being too extended in itself to have any place in this brief address. But in the number of the *Official Gazette* for Feb. 18, I find a decision which definitely settles an important question in such a manner that it may be convenient for many here to know of it.

A rule of the Patent Office requires that separate inventions should receive separate patents. This resulted, during the late administration, in a decision that an invention of an apparatus and process, being separate inventions, must be separately applied for. It was not denied that a patent for both process and apparatus was good, for that was just the sort of patent which Mr. Bell got, but it was said that the Patent Office would not allow any more such. The inconvenience resulting from that decision seems to be cured by a case just decided by the present very intelligent and judicious Commissioner of Patents, reported in the last number of the *Gazette*.

Substantially it is now settled that, although a process and apparatus for carrying out the process are separate inventions, they are not necessarily *independent* within the meaning of the forty-first rule of the Patent Office; and when they are dependent on each other and mutually contribute to produce a single result, they may be joined in one application.

Under the head of "any new and useful improvement" we have had many interesting questions, from which, in the briefest manner, I deduce a few principles. A union of old mechanical parts in a new combination to produce a new and improved result, which is not a mere aggregation of the old results of the respective parts, is an improvement. In a patentable combination of old parts the constituents must qualify each other, so as to form a new machine of different character or function, or one producing a result due to the joint and co-operative action of all the constituents, which is not a mere adding together of separate contributors (101 U. S., 310; 26 F. R., 153).

The negative conditions of not being known by others, etc., of non-publication and of non-abandonment, must be treated in a passive way. The most interesting novelty under the first is a recent decision by the Commissioner of Patents (*Official Gazette*), from which it appears that a foreign inventor may, prior to application for a patent here, communicate a description to some person resident here, and that will enable him to defeat applications by others for inventions subsequent in date to his communication for the same invention. I have always regarded that as a favorable means by which a foreigner may prevent forestalling by those who, seeing his invention abroad, might claim it here, relying that, in an interference, he could not name any date of invention earlier than that of his foreign patent.

The other negative conditions, of non-use and abandonment, I must pass without a remark. Without any desire to be facetious I am compelled, on the whole, to say that the only safe answer to the question, "What is a patentable invention?" is that "it is an invention for which a patent can be got and kept."

Let us assume now that the patent is issued. The next thing of interest is: "How long will the granted monopoly last? What legal rights will it confer, and what, if any, causes, may affect it during the term for which it is granted?" These questions arise partly under the provisions of Secs. 4,886 and 4,887, of the Revised Statutes, and to those sections I shall limit myself as follows:

SEC. 4,886. Any person who has invented or discovered any new and useful art, machine, manufacture, or composition of matter, or any new and useful improvement thereof, not known or used by others in this country, and not patented or described in any printed publication in this or any foreign country before his invention and discovery thereof, and not in public use or on sale for more than two years prior to his application, unless the same is proved to have been abandoned, may, upon payment of the fees required by law and other due proceedings had, obtain a patent therefor.

SEC. 4,887. No person shall be debarred from receiving a patent for his invention or discovery, nor shall any patent be declared invalid by reason of its having been first patented, or caused to be patented, in a foreign country, unless the same has been introduced into public use in the United States for more than two years prior to the application. But every patent granted for an invention which has been previously patented in a foreign country shall be so limited as to expire at the same time with the foreign patent, or if there be more than one at the same time, with the one having the shortest term, and in no case shall it be in force more than 17 years.

The original granted term is seventeen years, unless the invention has been previously patented abroad, in which case that term will be limited to the term of any foreign patent then existing. This limitation defies justification or excuse. It exists in most foreign patent codes or systems, and was formerly in the English system. The wise revision given in 1883 by the British Parliament to the whole subject resulted, among other things, in its complete abandonment in the present Act, 46-47 Vic. In our system, as in all foreign systems, it is imitated from the old and now abrogated English model without, as I assume, any intelligent consideration of its motive or effect. The reason generally suggested is that State policy forbids domestic restrictions on the right to make a thing which is without restriction elsewhere. But this reason is manifestly too broad, for it includes all States in its purview, whether patents have been previously granted or not; whereas our Act regards only those States where the manufacture having been once

*Abstract of a paper read before the New York Electric Club, Feb. 20 1890.

restricted has become free during the currency of a like patent here. The reason must, therefore, be narrowed to fit the case, and not overlap.

Now, no person can suggest a real, as distinguished from a merely formal and perfunctory, reason why the expiration of a prior foreign patent should end a domestic patent, which would not be equally applicable to the case where the foreign patent is not prior, but subsequent; or to the case where there have never been foreign patents. If the motive is to make that free here which is free elsewhere, then the history of the foreign freedom—whether it has always pertained to the subject or has once been granted away and afterward recovered—is immaterial. If the existence of a monopoly abroad is in any case a reasonable condition of monopoly here, it is indifferent whether the absence of such foreign monopoly is due to its having been ended, or to its having never begun. If it ought to end here when it ends there, *pari ratione*, it should not begin or continue here unless it also begins or continues there.

But, indeed, there is no such reason. What public or private end needs such a provision? Certainly none but the sporadic and unavoidable interest of those who like to see another drop something that they may pick it up. In what—adopting the narrowest and most selfish maxims of our guidance—is the American people injured if the Spanish people enjoy freely an article on which we must pay royalty? The patented article cannot be introduced here while the patent survives, however cheaply it may be made. Its cheaper product is kept out by a barrier more lasting than a patent term—protective tariff interest.

I can conceive of but one really useful result from what I say to you to-night—it is to induce every member to seek a repeal of sec. 4,887, so far, at least, as relates to patents to be granted.

The history of the troubles of inventors under this section shows that the question first arose in a case where an English patent for fourteen years had expired and was afterward reinstated. It being prior in date to an American patent for the same invention, the court held that when the fourteen year term of the English patent expired, the American patent expired, and that the English re-instatement could have no effect to revive the dead American one. That case was followed by a short series of cases arising under a different state of foreign law, to wit, Canadian patents issued under the peculiar terms of the Dominion statute, for five years, with a privilege of renewal for two succeeding terms of five years each. In the Circuit Courts these cases were deemed to be like the English one, although grace and favor, was the legal basis of one, and legal right of the other. Finally, this question reached the Supreme Court in the noted case of Bate v. Hammond. The Supreme Court in that case decided that a Canadian patent which carries with it a right in the inventor to take the successive five-year-terms without consulting any one is virtually a fifteen year patent from the beginning. But this natural and logical result did not take cases arising under Section 4,887 out of the woods. On the contrary, some expressions in it have brought doubt upon another class of cases, in which the foreign patents come to an end, not by the expiration of their original terms, but by failure to pay taxes or perform some other continuing condition called by lawyers conditions subsequent. That question is now before the Supreme Court in a case submitted within a few days past, and decision may be looked for soon. I shall not repeat to you the arguments. Suffice it to say that the interpretation, which I hope will prevail in the Supreme Court, is that the only conceivable motive for limiting the American term, by reference at the time of the issue to foreign terms, is that certainty may be attained in the beginning as to the duration of the American patent. It is necessary that buyers, sellers, licensees, infringers, and the whole public should, at all times, be able to learn just how long a patent has to run. This certainly *is* attained if the term of the foreign patent then in existence is definitely adopted as the measure. Under that condition we have an unchangeable record to go to to ascertain how long the American patent was issued to run. I have said I shall not repeat the argument in this case: but I may call your attention to some of the incongruities and absurdities and possible oppressions which may result from a contrary decision. To stimulate every inventor to use his influence with Congress to have the section repealed, I will mention a few instances in which that interpretation would have results so contrary to all that is reasonable as to create doubt as to whether Congress intended it. After the decision of Bate vs. Hammond, a defendant amended its answer in a suit brought against it by the Edison Company, by setting up the fact that the Canadian Edison patent for a lamp, composed of a filamentary carbon of high resistance, in a glass globe hermetically sealed, etc., had been put an end to by the proper functionary at Ottawa, on the ground that the invention had been imported contrary to law and had not been manufactured in Canada as required by law. It was true that such judgment had been rendered and the Edison patent declared void. Had the American case then come to trial, the Circuit Court must have decided (under a decision rendered last Summer in a beer-cask case, where breach of the condition subsequent to pay taxes was held to have terminated an American patent) that the Edison filament patent would have come to an end here. This would have been a very serious consequence, I think, to its owners, but since that time the case against the Canadian patent had been re-heard and decided exactly the other way, so that it now appears the Canadian patent has not come to an end, but remains in force. Suppose a final decision against the United States patent had been rendered before this re-hearing and correction of error in Canada, that subsequent correction of its errors by the Canadian tribunal would have no effect to revive the lost American patent. The false rumor of its Canadian death would have killed, but a revelation of the truth could never have restored it. In an old sea song the false and married sweetheart attempts to excuse her treason to the returning sailor and says:

"For somebody came to me and said,
That somebody else had somewhere read,
In some newspaper, John, as how you were dead."
"Dead, damme, I haint been dead at all," says Jack Robinson.

But conceive the humiliation which every honest mind would feel if, by operation of law, a great property should actually and irrevocably fail on a mere false rumor, which is substantially all there was of the original Canadian judgment; for, upon examination, it turned out that the person who professed to decide the first hearing had no legal authority, and upon the examination by the functionary who had, it turned out there were no such facts as the first officer relied on.

But other possibilities, equally monstrous, result from the provisions of foreign laws. In many foreign countries patents are terminated for the doing of things which the policy of our law expressly approves. For instance, in England, prior publication rendered a patent void. Consider the effect of this in the case of Mr. Bell, when he filed his principal application, in 1876, and simultaneously sent an application to Great Britain. He was put in interference here with Gray. You all know the delays which may thus result. The interference was vacated. But suppose it had not been, and the customary delays had occurred, so that the English patent had issued first. In the meantime, Bell gave to Sir William Thomson one of his telephones to take home. Sir William in some way bent the diaphragm on the journey, and, being unfamiliar with the instrument, did not restore it. He produced it in that condition before the British Association. Of course, it did not talk. When the English patent was sued upon, it was set upon as a defense that this prior exhibition rendered the patent invalid. But the plaintiff succeeded, on the ground that a telephone with a bent diaphragm was not Bell's telephone. Now, we have only to supply two accidents, viz, that Gray's interference had been retained sufficiently long, and that Sir William had thought to restore the bent diaphragm, and we should have seen the original Bell patent lost in England for a prior publication which would have been innocent here, and then lost here, because it had been lost there.

Can it be supppesed that Congress means to punish an American inventor because some stranger does that in England which is perfectly innocent here? Yet that is what the present state of our laws, as interpreted in the beer barrel case, implies.

I will mention another possible case. In Peru, the law allows any person who considers himself interested to demand the nullity or cessation of a patent. All patents are to be declared null if they are not new. Peruvian law defines a "new invention" as one which has not, previous to the Peruvian application, had anywhere sufficient publicity to put it into practice. Now, our laws allow two years' public use before application for a patent. Suppose an American inventor, first putting his patent in the allowed and encouraged public use of two years, then applying for a patent here and incurring the not unusual delay, then going to Peru, and, by reason of the greater administrative promptness, obtaining a patent there before his application is acted on here. The Peruvian patent being out, and the American patent being out, but of later date, any one in Peru who deemed himself interested might bring suit to set aside the Peruvian patent, because the United States two years' public use constituted—as of course it would—"sufficient publicity in the United States to put it into practice," according to Peruvian law. On this, the Peruvian patent would be declared null—which is their affair—and then the American patent would have to be declared null, substantially for the public use in the United States, authorized by law. Thus you see how a man can get himself punished in his own country for a lawful act.

These illustrations could be numerously repeated. Take the case of Austria. Austrian patents are annulled when granted on foreign inventions, which are not at the time patented in the place of their origin. From this it might result that an American inventor, applying here first and afterwards in Austria, and from circumstances beyond his control obtaining the Austrian patent first, should have it taken away because being unable to get his own office to act in time, he had not patented the invention in his own country first; and, thereupon, he at once would be liable to lose his American patent subsequently obtained as a proper punishment for having lost the prior Austrian one.

Among the numerous patent laws of the world—something more than fifty—the continuance of patents is predicated on some very absurd conditions subsequent. In one British colony the patentee is required to supply to Her Majesty's officers the patented article at such times, and at and upon such reasonable prices and terms as shall be settled for that purpose by the governor. Now I am not going into the question whether this does not mean patented articles for Her Majesty's use. We know how easily this sort of thing is arranged, and how many things are supplied ostensibly for public use, which really go to the comfort and convenience of public servants. But conceive of it; because a petty functionary of British Guiana chooses to set the price of a patented hair-oil, or pipe-claying material, at a figure at which it could not be supplied, the provincial patent shall be annulled, bringing with it as the vast consequence of a trivial cause the loss of a great American property.

There is reason in all things, and this section which I have been criticising is capable of being read with reason; and so read and interpreted, it is less offensive to public and private interests. It is my hope that during this term the Supreme Court will establish that reading.

Under the head of what things may terminate the efficiency of a patent, of course, it would have been right, first to speak of the expiration of its natural term, but that goes without saying. It also goes without saying that although a patent does not come to an end, its usefulness may cease by its claims being declared by the courts null and void for want of novelty, etc.

There is also another case which has lately been brought before the Supreme Court—that in which the Government itself demands the annulment of a patent whose issue has been obtained by fraud. That such a jurisdiction exists was disputed, but has been finally established in a notable case, leaving the question of fact whether there was any fraud for subsequent determination.

DISCUSSION.

Mr. E. P. Thompson: If a certain precaution and time and expense is gone into soon enough, the foreign patents may all issue on the same day, and then they may continue to last a certain number of years which can be protected. If the patents be taken out in Russia, and in one or two other countries where the term is comparatively short, those can be applied for a little later without doing any harm to any of the patents; but in all countries where the terms are substantially the same as the United States term, all these difficulties can be overcome by taking certain precautions and making arrangements to have all the patents issued on the same day.

Mr. C. G. Curtis: The tests of what constitute patentability which have been given by the Supreme Court, are based upon the hypothesis that there is in the mind a constructive faculty, a faculty of producing an invention by creating something that did not exist before. These are very unsatisfactory. Some of the most common tests that the Supreme Court applies is whether it required invention, whether there was any ingenuity, whether the inventor exercised the intuitive faculty, whether it has a double use, whether the invention was obvious or not. Of course, all such inquiries are entirely futile and unsatisfactory. To the mind of an inventor like Mr. Edison, what would appear to be the most obvious thing in the world, would be the most difficult and impossible to invent for most of the judges of the Supreme Court, so that no two men can be expected to agree as to whether it was obvious or not. I think it was first proposed as much as twenty or thirty years ago—a test of what constitutes an invention, which has very much more logic in it, though it perhaps is as difficult to apply as any other test which has ever been suggested—that is, whether the elements stated in the claim to constitute the invention, co-operate, have a joint action to produce a new result. In probably ninety-eight cases out of a hundred that test could be applied, and applied intelligently, and it is possible to arrive at a satisfactory result in that way. That is the test that the Patent Office has been applying, and whenever they are able to apply it satisfactorily they generally decide questions of patentability in that way.

Mr. L. W. Serrell: Many patents have been defeated before the courts, because the question has not been presented with sufficient common sense to enable the court to understand the questions of novelty and utility. I am well satisfied that the most important thing for an inventor, and to be urged on examiners in the patent office, and upon the commissioners and everybody concerned in patents, is the exercise of common sense in getting up an invention that is useful. Another point which Mr. Lowrey did not refer to, regarding section 4,887. This was intended to prevent a foreigner from coming here and obtaining a patent which would run longer in this country than it did in his own country. I have urged for years, and I wish the profession would join in it, that where a man residing here applies for his patent in this country before he applies for his patent abroad, no matter when that patent is subsequently granted, it should be granted for the term of 17 years. The profession should join in urging Congress to enact in connection with 4,887, that this section shall not apply upon any patent granted upon an application for the United States, before a foreign patent is granted.

Mr. G. M. Phelps: Mr. Lowrey has cleared up our ideas to a very large extent in respect to many questions, and he has given us a good deal of positive information and an uncommon amount of pleasure. Inventors and electricians, however, with all the drawbacks of the patent system, including those Mr. Lowrey refers to, have had a pretty comfortable time under it. But there are other classes who need similar protection. The authors and printers are agitating that subject with some prospect of success. I have a resolution here which I would be pleased to offer, if in order:

Resolved, That the Electric Club of New York is in hearty sympathy with the effort of American authors, publishers, employing printers and workmen in the printing trades, to obtain from Congress a just recognition of the rights of intellectual property, and we hail with satisfaction the prospect of an early passage of the International Copyright bill.

I think we will be pleased to hear from Mr. Johnson, who is thoroughly familiar with that measure.

Mr. Phelps' resolution was duly seconded and carried.

Mr. Robert Underwood Johnson, Secretary of the American Copyright League: The authors in this country have always contended that the copyright question was one which should not be left to them; that it was a question of national interest, of the welfare of our country, not merely one of dollars and cents—whether the American author should receive a little more or a little less—but a question of the actual tone of the literature of this country. Whatever may be the drawbacks and the difficulties which are encountered by inventors, they have been able, under certain conditions, to obtain a due reward, at least a measure of protection, at the hands of our government; I mean both reciprocally for their own inventions abroad in foreign countries, and also the inventions of foreigners in our own country. Had the same policy been pursued with reference to authorship, I think, we may say we should have had a similar condition of prosperity. As it is, it must be confessed with considerable shame, a shame which, I think, is the shame of the whole country, that the development of our literature has been very far in arrears, behind the development of the mechanical or even the material resources of the country. Mr. Lowrey has briefly referred this evening, I am told, to the announcement which has been made by the Count de Keratry in regard to the state of feeling in France relative to the question of retaliation in case the copyright bill should not pass. Our sins against France have been especially grievous and long continued, in the matter of copyright. We have not only taken without compensation French intellectual products, but we have often mutilated them. Not only has that been the experience of Frenchmen, but it has been our experience in other countries. I recall a popular novel in which reference was made to the President of the United States, which was altered by the English pirate to substitute the name of the Queen for the President, and the drawing-room of her Majesty for the President's annual reception on New Year's day. I shall merely say a few words in regard to the provisions of the present bill, for the present bill is the only bill that ever will be passed in my opinion, after several years' connection with this movement. It is the only bill upon which we have succeeded in uniting all the interests which are touched by the operation of such a law. The authors are almost to a man in favor of this bill. The publishers and employing printers, at the annual convention of the Typothetæ, in St. Louis, in August, warmly indorsed the bill after a full discussion. The printers' unions are all in favor of this bill, and it has been arrived at by the concessions by the different interests, with the view to doing away with this standing disgrace to our country. The present bill provides for the excision of the word "citizen," by which in the year, I think, 1819, the constitutional provision was limited by statute. It seems that statutes have been the great enemies of authorship. The common law of England gave authors rights in their productions. The statute of Queen Anne, which was intended merely to confer a remedy at law against literary piracy, has since been construed to have limited the right from a common law right to a statute right. Our constitution made no such limitations, but the statute of 1819 did; and we are, therefore, to-day in the position of a profession which the constitution has broadly authorized Congress to permit, and for which a special statute was passed in its interest, which is to-day the prey of the very legislation which was passed for its own benefit. If we had excluded foreigners from the operation of our law, and then had built a Chinese Wall about our country, whatever our literature would have been, it would have been our own. As it was, we made such enormous loopholes in this wall that all the foreign literature came in in pirated form, and we find ourselves as a nation more familiar with the institutions of England and France, with the alien ideas, many of which America was founded to get rid of, than with the traditions and mythology of our own country—for we have beautiful Indian mythology and historical traditions. Your action to-night in regard to this measure will be of great interest to us, and all the more interest because it is taken in sight of the fact that there is danger if the copyright bill is not passed, there will be a retaliatory measure taken by France. I discussed this question with the Count de Keratry, when he was here as the agent of the Scientific and Inventive Societies of France, last November and December. He has since returned to France with the special object of making a study of the public sentiment there, and he assures me that while it has never taken official form and cannot be regarded, as far as the government is concerned, as a threat (though for that matter, the menace is the weapon of diplomacy), yet there is a growing sentiment in influential quarters that if the copyright bill be not passed it may result in the withdrawal of France from the Berne Conference for the protection of industrial property, that is, of patents, into which our government entered, although we declined to enter into a similar convention for the protection of literary property. I think there is very little more to say, except to report the favorable progress made with this bill. It was referred in the Senate to the Patent Committee, and by the committee favorably referred back to the Senate. In the House it was referred to the Judiciary Committee, and not to the Patent Committee, of which Mr. Simons is a member. He thought it was properly within their province, and they introduced an almost identical bill and had it referred to their committee. So we have it now reported to the House unanimously from both committees favorably, with two or three members in each committee retaining the right to offer amendments on the floor of the House in case they should feel inclined to do so, which is a very usual proceeding when a man is in doubt about a measure. The result will be that we shall have two large committees of men who are educated in the principles of this bill, who will be able to defend it before the House. I, therefore, think I may promise you that with the activity of our friends we shall soon be able to announce the passage by the House of Representatives of this important and valuable measure, and, as we feel very certain that the Senate will follow the House in this matter, that we shall soon be able to extinguish a blot upon our escutcheon which has been there for 50 years, to the disgrace of the whole country. [Applause.]

Good Electric Car Records at Erie, Pa.

When electric railways were first introduced, it used to be commonly said among street railway men that the motors were not built sufficiently durable and strong for the necessities of street-car service. Such charges might have been true at that time, but they are certainly not applicable at the present day. The durability of the electric street railway motor, as exemplified by the productions of the leading companies of to-day, is probably as high as, if not higher than that of any other machine exposed to the same kind of service.

We are in receipt of some quite interesting statistics from Erie, Pa., in regard to the operation of electric cars upon the line of the Erie Electric Motor Company, in that city, which illustrates this in a striking manner.

One motor car on this line has run 19,300 miles without requiring any repairs of any kind. A second car, equipped with only a single motor, has run 15,000 miles without repairs being required, and other cars have records very nearly as large. When the arduous work required of these street railway motors is taken into consideration, this is truly a remarkable record, and one which is most gratifying to all interested in electric traction.

The Erie electric railway has been in operation for a number of months on the Sprague system, and is said to be giving great satisfaction to the managers of the road and to the general public. The equipment of the road is complete in every respect. At the station the power plant includes two 150-h. p. Ball engines with 16 by 16 inch cylinders, each engine being belted directly to two 50,000 watt railway dynamos, which furnish the current to the line. The motor car equipment consists of fifteen electric cars, equipped with the Sprague improved motors and all the latest attachments and devices used by the Sprague company on its cars.

When the installation of this electric line was proposed, there was considerable opposition from property owners along the route who were not acquainted with electric railway systems, and objected to the novel form of power. The road has become very popular, however, on account of the rapid transit facilities afforded, and has carried large numbers of passengers since it has been in operation.

Electric Railway Decision at Albany, N. Y.

An opinion was rendered at Albany, on Feb. 24, in the Third Department of the New York State Supreme Court, by Judge Landon, Judge Learned concurring, in the suit of the Hudson River Telephone Company against the Watervliet Turnpike and Railway Company, as to the use of the single trolley system. After discussing the main points of controversy now familiar to electricians, the decision says: "The method which either party should employ for the return circuit for its current of electricity is not defined in the grant of its franchises, and therefore is not expressly, much less exclusively, bestowed." It adds: "Upon the evidence before us it seems to be true that the single trolley system adopted by the railway company is the best now known, regard being had to mechanical, electrical and financial considerations, but without regard to electrical interference with the telephone, which uses the grounded or earth circuit instead of a metallic circuit. The plaintiff does not use the metallic circuit. It is much cheaper to construct the metallic circuit for the telephone than for the railway. It appears to be shown by the evidence that the metallic circuit, if employed by the telephone company, would obviate the electrical interference of which plaintiff complains. We should certainly, in the interest of the public, as well as that of the railway company, permit the latter to construct its road upon the most approved system. Other methods for the protection of the telephone are suggested. But it does not appear that any other is equally effective to prevent disturbances. To construct the metallic circuit for the telephone would be expensive, but how expensive does not appear. Assuming then, that the adoption of a metallic circuit for the telephone is the most reasonable method of obviating the injury from electrical interference, the question will arise whether the telephone or railway company ought to bear the expense."

After a discussion of the equities involved in the question, which shall assume the expense of metallicising its circuits, the opinion concludes: "But we cannot now well decide who will ultimately be liable for this expense, or whether equity requires its apportionment. This matter was less fully considered upon the argument than the electrical and other important features of this somewhat novel case. We cannot place the burden of this expense in the first instance upon the defendant, since the plaintiff ought not to yield control of its lines to the defendant. The necessities of the case compel us to require the plaintiff to assume it in order to protect itself against the defendant.

Ordered, that the injunction be continued as follows for 30 days and until the defendant shall stipulate:

1. That the court may determine on the trial what has been, or what will be the necessary expense, to the plaintiff, of preventing, by metallic circuit or otherwise, the injury to, and interference with, the operation of their telephones complained of in the complaint.

2. And that the court may further determine on the trial what damage, if any, plaintiff has sustained to his business, or will sustain by reason of the matter set forth in the complaint, before the same can be with reasonable care prevented as aforesaid.

3. And that in this action the court may adjudge to the plaintiff against the defendant such recovery for said expense and for said damages as may be just and equitable on the proof established at the trial.

3 B. And further, until the defendant shall have given to the plaintiff a bond in the penal sum of —— dollars, with two sufficient sureties duly acknowledged, said sureties to justify in the usual manner; conditioned that the defendant will pay to the plaintiff any sum or sums which may be adjudged against defendant in this action.

C. Upon the giving of said stipulation and bond the defendant may apply on two days' notice to any judge of the General Term for a certificate that said bond and stipulation have been duly given. On filing said certificate the injunction shall be raised.

D. Should the injunction be vacated as above provided, the plaintiff may, within twenty days thereafter (or such further time as may be granted by any Justice), serve a supplementary complaint so as to seek the recovery of such expense or damage or other or further relief as it may be desired.

The costs of this appeal ordered to be settled."

Denial of Patent for Storage Car Propulsion.

A special dispatch from Washington of Feb. 24 says:

Commissioner Mitchell of the Patent Office to-day rendered a decision denying the application of C. A. Faure for a patent for alleged new and useful improvements in the application of secondary electric batteries as a motive power for the propulsion of vehicles. It was urged on behalf of the applicant that he was the first to practically and commercially succeed in accomplishing the desired result; that prior to his invention chemical generators of electricity had been employed to propel boats, engines and vehicles, but owing to the weight of a cell of battery all the electrical energy it was capable of generating was expended in moving itself, and he, being the first to apply a newly-discovered property to this use, was entitled to protection.

The commissioner holds that the application of the Faure secondary battery to the propulsion of vehicles was an obvious use, requiring no change in the battery or in any of its parts to adapt it to the specified purpose, and that to use a better battery in a combination in which an inferior one had been previously used did not involve the invention of a new combination for which the skilled mechanic would be entitled to a patent.

The commissioner further holds that the public are entitled to practice a given invention in all its obvious utilities when the patent has expired, and may not be lawfully debarred from the enjoyment of it by subsequent patents seeking to monopolize uses which, although special, are at the same time recognized by persons skilled in the art as pertaining to it.

The State Senate Electrical Investigation.

The Senate Committee on General Laws, which has been appointed to investigate the subject of dangers from electric shocks, with a view to the enactment of laws to obviate them, held an adjourned hearing at the Hotel Metropole, on Feb. 24. There were present of the Committee Senators Erwin, Cantor, Van Gordon and Coggeshall. Daniel L. Gibbens, ex-Commissioner of the Board of Electrical Control, was present, representing, he said, "certain members of the Board." Paul D. Cravath, counsel for several electric-lighting companies; Everett P. Wheeler, counsel of the Edison Light Company; George Bliss, on behalf of property owners, and other attorneys were also on hand.

EDWARD F. REYNOLDS, the Chief Clerk of the Coroner's office, was the first witness. He produced a list of cases in which deaths had resulted from electric shocks, and in which inquests had been held. The list was as follows: Meyer Streifer, April 15, 1888; Frederick S. Witte, April 27, 1888; Thomas Murray, May 11, 1888; William Maier, July 16, 1888; Nelson Richardson, Edward Quinn, June 27, 1889; Darwin A. Henry, Sept. 2, 1889; Joseph Mazza, Sept. 13, 1889; Charles Erdman, Oct. 8, 1889; John E. H. Feeks, Oct. 11, 1889; Henry Harris, Nov. 30, 1889; Peter Clausen, Dec. 10, 1889; Patrick Sullivan, Dec. 14, 1889; J. Simpson, May 3, 1886; George Schweiger, Oct. 24, 1887.

Mr. Reynolds said that he had not had time to look up the records further back than 1887.

Dr. JOHN T. NAGLE, of the Bureau of Vital Statistics of the Board of Health, also produced a list of deaths from electric shock which had been reported to the Board of Health. It corresponded with the list given by the preceding witness.

Mr. GIBBENS also went on the stand. He was first asked to give his views as to high-tension and low-tension currents. There was no dividing line, he said, between high and low tension currents. The general rule, he believed, was to apply the term high tension to currents over 250 or 300 volts. A high-tension current would kill a man much more quickly than a low-tension current, but the latter might cause more torture, and produce death just as surely. It was, he thought, more painful to be burned to death by low tension, than killed immediately by a high-tension shock. The horrible death of lineman Feeks resulted, it was believed (by Mr. Gibbens), from contact with a low-tension current.

JAMES H. SEYMOUR, President of the Clark Electric Company, described the arc system of that company, touching upon the special safety apparatus for broken and crossed circuits, recently invented by Mr. E. P. Clark, their electrician.

At the Friday's session, Mr. Geo. W. Hebard testified as to the manner of conducting business adopted by the United States Electric Light Company, and stated that the deaths from electricity had been caused either by circuits that had been badly constructed in the first instance, or that had got out of order through want of proper care and supervision. Senator Erwin here said that the committee had engaged the services of Mr. F. W. Jones, of the Postal Telegraph Company, who, as an electrical expert, would assist the senators in their investigations.

Mr. R. R. BOWKER, President of the Edison Illuminating Company, spoke of the small number of deaths by electricity compared with other causes, and stated that one of the most distinguished statisticians in England told him that the number of people kicked to death by horses every year far exceeded that of deaths by the railway; he added, however, that that could not be put forward as an argument for abolishing horses.

Mr. C. O. MAILLOUX and Mr. C. H. JACKSON were in favor of underground service, but agreed that if properly insulated the overhead wire had points in its favor.

Mr. E. C. TOWNE created quite an interesting episode in the investigation. On being asked by the chairman to give his views on the question before the committee, he launched out into an elaborate disquisition on the nature and phenomena of electricity. As he warmed to his work, and discoursed on such things as atoms of matter enveloped in electricity, protoplasms, and the like, the reporters looked up from their note books, and the committee were puzzled. The senators tried conscientiously to follow the flow of erudition, but became every moment more bewildered. At last the witness declared that electricity consisted of infinite atoms of matter moving with infinite rapidity. The senators appeared relieved as if the worst had happened, and the chairman asked the witness if he could give them any practical information as to overhead wires and underground systems. He said he could not, but he considered that if the wires were placed underground they would be out of the way, and if an overhead wire were perfectly insulated it would not be dangerous to human life.

The committee adjourned to the 3d inst.

The Phonograph in the New York Electrical Society.

The announcement that the meeting of the New York Electrical Society, held on Wednesday last, was to be devoted to a paper on, and exhibition of, the Edison phonograph, brought out an audience which completely filled Clinton Hall.

The phonograph, which was in charge of Messrs. M. J., and M. C. Sullivan, of the Edison General Electric Company, was described in an interesting paper, in which its early history, which will always be of interest, was alluded to, and in which its present functions and capabilties were brought out.

Then followed the reproduction of many instrumental and vocal solos, quartettes, etc., and the reproduction of speech. The finale was the reproduction of the Christmas chimes of Grace Church—a most striking piece.

The meetings of the New York Electrical Society are attracting very good attendance, and the membership is constantly on the increase. The list of papers announced for future meetings presents a number of interesting subjects. The next meeting, announced for March 12, will be devoted to an address by Mr. T. C. Martin on "The Social Side of the Electric Railway." This will be profusely illustrated by the magic lantern.

The Reorganized Baxter Company.

As we stated some time ago, the reorganization of the Baxter Electric Manufacturing and Motor Company under the name of the Baxter Electric Motor Company has been effected, and the company are now in shape to push their motors and generators upon the market. During the partial inactivity of the Baxter factory, Mr. David E. Evans has been personally supplying old customers with motors, repairing their parts and furnishing new parts and supplies. Now that the company is reorganized it has shown its wisdom in retaining Mr. Evans in the management. The new officers are: E. G. Hight, president; R. B. Griffin, secretary and treasurer, and David E. Evans, superintendent.

One of the staff of THE ELECTRICAL WORLD recently had the pleasure of inspecting the factory, and was impressed with the splendid opportunities that its size, location and facilities give it for turning out electrical machinery. Mr. Evans says that not only will the arc and incandescent Baxter moters be turned out faster than ever before, but that the recent inventions of Mr. William Baxter, Jr., including the generator and street car truck (in which the wheels are self-contained motors) will soon be ready. The president of the new company, Mr. E. G. Hight, is one of Baltimore's eminently successful business men, and in his hands the future policy of the company will rest. The secretary and treasurer, Mr. R. B. Griffin, will bring to his new duties a long experience in positions of trust which will well adapt him for the place. The offices of the company are located at the works, corner Chase and Biddle streets, Baltimore.

The National Fast Telegraphing Tournament.

Mr. F. Catlin, the manager of the National Fast Telegraphing Tournament, sends us the following latest information on the subject:

The conditions governing the coming National Telegraphing Tournament are:

1. Number of words to be transmitted: From 250 to 500, according to number of entries.

2. Qualifications: Speed combined with excellence.

The instruments to be used will be furnished by the leading electrical manufacturers who have contributed money for prizes.

CLASSIFICATION.

Class A.—Open for all.

Class B.—Open for all, barring those who have a record of better than 11 minutes on the 500 words used in the last contest.

Ladies Class.—Free for all.

Old Timers Class.—Open for those who were in the service prior to 1865.

Entrance fee $2, except in the ladies class.

The transmission by each operator will be recorded with a caligraph in the hands of an expert operator, thereby illustrating the value of the writing machine worked in conjunction with the telegraph.

Under date of Feb. 17, C. W. Summers, manager of the Western Union, office at Schriever, La., addresses the manager of the Western Union Telegraph Company of New York as follows:

"I will challenge the winner of the first prize in the coming contest to be held in your city in April next, to determine the shortest time a given number of words can be telegraphed, in a like contest of 100 words for $500 a side. Same to take place at any given place and time. Please inform committee."

Mr. T. A. Edison has shown his interest in the tournament by sending the management a liberal subscription.

The tournament will be held at Hardman Hall, Fifth avenue and Nineteenth street, Thursday, April 10, with afternoon and evening sessions.

Special Correspondence.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
167-177 TIMES BUILDING, NEW YORK, March 1, 1890.

Mr. J. H. Finney, of the Fidelity Carbon Manufacturing Company, St. Louis, has been in town, and reports a fair trade in his line of goods.

The Peckham Street Car Wheel and Axle Company, 239 Broadway, have issued a handsome leather-bound pamphlet, and set of circulars, relating to their many specialties, as described in your columns from time to time.

J. J. McCabe has moved to 68 Cortlandt street, from 121 Liberty, and intends to hustle up the trade in Fitchburg Machine Works tools among electrical manufacturers. He has taken the whole building, and is stocking it with a full line of machine tools and supplies.

Mr. F. B. Aspinwall, 112 Liberty street, is the selling agent for the Hoffman damper regulator, and has put up hundreds of them all over the United States. He is installing one in the Jersey City Electric Light Company's station, where it will control six boilers. He has lately put in one of his Lyman & Warren improved steam exhaust pipe heads at the Burlington, N. J., electric light station and at Lebanon, Pa., for the Edison Illuminating Company.

Carl E. Waldeck, vice-president of the Globe Fan Company, 368 Broadway, started last Friday by steamer for Charleston, S. C., to push the trade in Globe fans among the electric light and power stations, as well as others, and to establish agencies for these fans throughout the South as far as Texas and north to Kentucky, taking all the cities en route. These fans are made of brass and highly finished in nickel, and have a fine appearance. An illustrated circular will be sent to any address.

McIntire Joints.—C. McIntire & Co., 13 to 15 Franklin street, Newark, N. J., have just received an order from the International Bell Telephone Company, at Antwerp, Belgium, for 1,400 copper connectors, No. 16, or 1.25 m. m. bronze wire, and 16,000 of No. 15; 20,000 copper connectors No. 12 hard drawn copper for telephone work; for 4,400 copper and iron wires, No. 12 iron and No. 18 copper; 500 for No. 12 copper and No. 12 iron; 400 for No. 4 cable and No. 6 solid wire for mast arm work. These and other orders make a total of 60,000 connectors ordered in one week.

Hatzel & Buehler, 29 West Twenty sixth street, are increasing the plant of the Edison Illuminating Company at Newport, R. I. The company bought up all the arc and incandescent plant. The old arc plant is to be moved to the new annex of the Edison station, 40 × 70, one story high, now under construction. This annex will also contain all the increased power plant for the Thomson-Houston electric railway system. Edison generators will be used, it is said. Hatzel & Buehler are also putting in electrical attachments for releasing the horses and lighting electric lamps in the ambulance stables from the general office. The contrivance is novel and will release any horse desired. When the ambulance leaves the stables, the doors close automatically and the current is turned off from the lamps.

The Electrical Construction and Supply Company, 18 Cortlandt street, have just brought out a new and improved arc lamp for incandescent circuits for 100 to 125 volts with two lamps in series, and using eight ampères of current. Two lamps shown me at their offices burned most successfully. The carbons were consumed evenly all around, giving a steady light, with no flickering, sparking or noise. The lamp is simple in construction, but of neat and compact design. The carbons used are of the ordinary domestic manufacture. The mechanism is strong and will stand rough handling, such as arc lamps but too often get. The long experience had by the company in this line has educated them up to the requirements of arc lighting for low-tension circuits, and they are meeting them.

Woodbridge & Turner, 74 Cortlandt street, New York, have just completed the equipment of the South Nashville Street Railway, Nashville, Tenn, with the Sprague system, the first car having been run over the line last week. The road is about five and a half miles in length. They use the silicon bronze trolley wire made by the Bridgeport Brass and Bronze Company, of Bridgeport, Conn., and speak in high terms of its tensile strength; power is furnished from the Thomson-Houston Electric Light Company's station, pending the erection of a new power plant. There will be 10 cars. The Brooklyn & Jamaica, L. I., Electric Railway, equipped by them last fall, is running very satisfactorily, using seven cars, of the Lewis & Fowler Manufacturing Company's make, 10 miles of track, Sprague system. They are doing general electrical engineering and construction work, installing complete arc and incandescent plants and electric railways. They are supervising portions of the work on the Nashville & Edgefield and the Main St reet & Lisbey Avenue lines, Sprague system, with 10 cars on the two lines of Pullman make.

Electric Light from Gas Engines.—A highly interesting fact has been brought out by Mr. O. Tirrill, of 39 Dey street, New York, in some practical tests in producing electric light by using illuminating gas for driving a gas engine and a Perret dynamo. Naturally one would suppose that the loss due to the double transformation of energy in producing the electric light from illuminating gas by this means would place the cost of the electric light far above that of gas. On the contrary, however, Mr. Tirrill has found to his surprise that a given amount of gas will produce far greater illuminating effects when used to drive this dynamo than when burned direct. The gasolene gas is produced by his machine for $1 per 1,000 ft. The engine, it is found, consumes four feet of this gas per 16 c. p. lamp per hour when driving the dynamo under full load, making the cost per lamp two-fifths of a cent per hour, so that the luxury of the electric light by this means, instead of being expensive, he finds in reality to be a great economy. Mr. Tirrill explains the phenomenon by the fact that his gasolene gas contains 80 per cent. of air when delivered at the explosion chamber of the engine, and he gets the benefit of the expansion of this large volume of air by the heat of the explosion.

Westinghouse, Church, Kerr & Co.—Five years ago Westinghouse, Church, Kerr & Co. established themselves as engineers in New York, occupying a small office on the fifth floor. Their business at that time was confined almost wholly to the handling of the Westinghouse standard engine. They were immediately successful from the first, and were soon obliged to find enlarged accommodations at 17 Cortlandt street. This office occupies the entire first floor of the building, and is handsomely fitted up as the headquarters of the company. The development of the Westinghouse junior and compound engines has greatly increased their business, and from time to time other engineering specialties have been approved and purchased by them, forming a large item in their business. They confine themselves wholly to the generation and distribution of steam power, in which department their experience has perhaps been as extended as that of any other concern in the country. The continuous growth of their business has required

the successive establishing of branch offices, first in Pittsburgh and Philadelphia, and later in Boston and Chicago. The office at Chicago is conducted independently of the New York office, and has been equally successful. St. Louis has always been an objective point, about which most of the western trade develops, and on Jan. 1, 1890, Westinghouse, Church, Kerr & Co. opened their fifth branch office at 511 North Fourth street, St. Louis, from which office the southwestern business will hereafter be handled. The Chicago and St. Louis offices are now controlling all the trade throughout the West and Southwest to the Rocky Mountains.

Primary Battery Church Lighting.—In my notes last week, I made brief reference to some work done at the Lee Avenue Congregational Church by Mr. W. S. Knox. I may add a few details I have since learned. It appears that Mr. Knox, having this work in hand, called upon a leading New York supply house, and was referred to Mr. J. H. Mason, of 120 Park avenue, for primary batteries for light and power. Mr. Knox bought eight cells of the No. 9 size, 7 x 5 inches, for illuminating an evergreen tree at the church mentioned, on Feb. 12, 13 and 14. Mr. Knox had the tree arranged to revolve, and to light the lamps either in batches or all at once. Connected in the same circuit were two owls, with electric lamp eyes, made to blink at intervals. A star fish fitted up with lamps was also included in this circuit and lighted at the same time. There were on the tree 36 lamps of from one to three c. p., and five more on the fish. Over the tree was a large Japanese umbrella with seven lamps of 2 c. p. each placed at the ends of the ribs, to be lit all at once, or separately. Another lamp of 6 c. p. stood constantly burning on a support by itself. All these lights worked automatically off the eight cells of Mason primary battery. A Pierce & Jones motor was run from two separate cells of Mason battery. I ought not to forget to mention that Mr. Knox was so pleased with the successful working of the batteries that he sent Mr. Mason a handsome present, and the Brooklyn *Times* made a nice note of the show. Mr. Knox is now using the cells for domestic purposes, and says that their work is more than is claimed for them.

W. T. H.

NEW ENGLAND NOTES.

Branch Office of The Electrical World,
Room 8, Cook Building, cor. Franklin and Congress Sts.
Boston, March 1, 1890.

Braintree, Mass.—The selectmen have granted the franchise for the construction of an electric street railway, as petitioned for by Hon. F. A. Hobart, Senator James A. Stevens and others.

Rhode Island electric men are congratulating themselves upon the appointment of Mr. Marsden J. Perry as president for the ensuing year of the National Electric Light Association, and will doubtless show a good front at the next meeting at Cape May. Bravo! for the "wee" State.

The Thomson Electric Welding Company are now doing such a large and progressive business that they have found it necessary to enlarge their premises, and have called for bids on a new building 154 feet by 60 feet, to be used as a carpenter shop, blacksmith shop and brass foundry.

Malden, Mass.—At the regular meeting of the Board of Aldermen, held this week, Alderman Russell moved that an appropriation of $18,000 be substituted for $16,000, in order to increase the number of street arc lights, for which the city is at present paying $90 per annum per light. The bill was passed.

Springfield, Mass.—The Street Railway Company of Springfield is making rapid progress with its preparations for its new electric line to Forest Park. Seven cars are now being built by the Newburyport Car Company, and most of the wire to be used has already arrived. The rails will be supplied from Scranton, Pa.

The Wainwright Manufacturing Company of Massachusetts, 34 Oliver street, Boston, the well known makers of feed water heaters, etc., have issued neat little ivory memorandum tablets to their friends. On the back cover is a very cleverly executed sketch in black and gold of their improved feed water heater.

The Suburban Light and Power Company, of Boston, Mass., is rapidly progressing with the installation of its machinery. The arc light apparatus, Westinghouse converter system, has nearly all been shipped, and the company contracted a few days ago for a 750 light dynamo of the Westinghouse alternating current incandescent system.

Curious Electrical Suit for Damages.—In the Superior Court the jury in the case of Florence Prout against the Pittsfield fire district rendered a verdict of $4,750 for the plaintiff. The suit was brought for $10,000 damages for injuries received by the plaintiff by a thunderbolt which entered her house on a fire-alarm wire, owned by the fire district. The case goes to the Supreme Court on exceptions.

Mr. C. B. Burleigh, the popular electrician of the T.-H. isolated department, received a very handsome surprise present from the twenty-four foremen under his administration, in the form of a very beautiful solitaire diamond ring, engraved on inside of which are the words, "From the Isolated Boys, '90." Mr. Burleigh is justly proud of his present, and the "boys" are equally proud of their superintendent.

Beverly, Mass.—The Selectmen gave a hearing last week on the petition of the Beverly and Danvers electric railroad for permission to run over the tracks of the Naumkeag road. The Naumkeag railroad opposed the petition on the grounds that the track was not laid with heavy enough rails to carry successfully electric cars. The Selectmen have taken the matter into executive session and will decide the matter later.

Woburn, Mass.—At a meeting of the stockholders of the Woburn Electric Light Company, it was voted to issue $100,000 first mortgage bonds on the property of the company, on a capital stock of $120,000. The company has been spending large sums on new construction work and increase of station capacity, and has taken this means of meeting all expenses. The bonds are likely to be taken up eagerly within the next few days.

Mr. John H. Craig, one of the experts of the Standard Electric Company of Vermont, has gone to Cambria, Wyoming, to superintend the installation of the 1,200 light plant recently sold to the Kilpatrick & Collins Company of that far Western city. The plant will be installed in the mines, and will be entirely underground, and will require some skillful work for the judicious and safe location of the lights and wiring.

The West End Street Railway Company have decided to do all their own construction work in the coming spring, and have so notified the Thomson-Houston Company. Mr. Dumoulin will have entire charge of the electric construction, and it is expected that the streets of Boston will soon present a very busy scene. Bids have already been asked for on cables for the underground feeders, and some very large orders for cable will soon be placed

Ware, Mass.—At a meeting of the citizens of Ware this week, it was decided to buy the plot of land opposite the Boston & Albany station, which has been under consideration for some time, and at an expense of about $40,000 to erect buildings thereon suitable for electric light and steam power plants, iron foundry and machine shops. One of the latter is to cost $10,000, and as soon as completed will be occupied by J. F. Porter, of Hatfield, manufacturer of lathes.

The Standard Electric Company of Vermont report the following sales: C. J. Bush, Pomfret, Conn., a 200-light plant for his private residence, farm house, stable and grounds. This dynamo will replace one of another manufacture. The Forest City Electric Works, Cleveland, O., 150 light plant, and Asa A. Cooke, Hartford, Conn., a 300-light plant. The Standard Company have now on exhibition in their office in Boston one of their dynamos, which is attracting considerable attention.

The Boston Electric Valve and Motor Company has been incorporated at Portland, Me., with a capital of $250,000. The officers are: President, William B. Chase, Swampscott, Mass.; treasurer, Henry M. Nichols, Boston; directors, Laban Heath, Revere, Mass.; Hiram Houghton, Northampton, Mass.; William B. Chase, Joseph Beals, William C. Bryant, Greenfield, Mass.; Henry M. Nichols, Frank W. Eddy, Westfield, Mass.; Henry A. Skinner, Greenfield, Mass.; Elijah N. Harding, Cambridgeport, Mass.

Electric House Lighting for the Back Bay, Boston.—A number of influential gentlemen of the Back Bay district, desirous of having incandescent electric lights in their residences, and not being able as yet to obtain them from the existing companies, have formed themselves into a company called the Back Bay Incandescent Light Company. It is proposed to establish a plant on the water front, with a capacity of 10,000 lights to start with. All wires will be underground. Considerable opposition may be expected.

The Legislature and the West End Railroad.—The Legislature has begun the hearing on the petition of the West End Street Railway Company for an elevated road, and Mr. Whitney has made an excellent speech explaining his proposed plan, which embraces an elevated road, as I have already written, for the narrower and more crowded streets in the city proper. General Butler entered a remonstrance, and spoke in favor of the Meigs system, which embraces an elevated road for the whole city and suburbs.

The Sherman Electric Protective Company have attracted considerable attention by their published intention, which, by the way, I announced some time ago, to bring suit against all alleged infringers of their overhead system. Mr. Sherman claims to have the fundamental patents, dating back to July 29, 1884, and the above company have bought out these patents and intend to proceed against all companies using the trolley system. No case has yet been tried, and it is needless to say that the fight will be a long and one hard if ever entered upon.

Brooklynites in Boston.—The Committee on Railroads of the Brooklyn, N. Y., Board of Aldermen, accompanied by several newspaper men, are in Boston this week for the purpose of inspecting the system of the West End Street Railway Company. Brooklyn intends to adopt in the near future some more expeditious system for street railroads than horses, and this committee has recently made a trip through the South and West for the purpose of examining the systems used. Yesterday they made an inspection of the overhead electric system, and to-day are visiting the power houses.

The Inter-Continental Telephone Company, operating the Bell telephone in Venezuela report that the Inter-Continental Telephone Company had Dec. 1, 1889, 716 subscribers at Caracas, and at La Guayra 142 subscribers, at Valencia 205, and at Porto Cabello, 296 subscribers; total, 1,154 subscribers; 275 waiting; 1,429 in all, as against 694 July 1, 1889. There are at present over 1,400 complete sets of Bell instruments, and over 1,500 miles of line wire in the plant, and a shipment of additional supplies, including a 400 circuit multiple switchboard, goes out by next steamer. Venezuela is making a good showing in telephone matters under the management of Bell telephone people of Boston.

The Southern New England Telephone Company, of Connecticut, will soon issue notes bearing interest at the rate of 5 per cent. per annum to an amount sufficient to pay off the present floating debt. These notes will be of two denominations, $500 and $1,000, and the amount of the issue will be limited to $100,000. They will be exempt from taxation, and the company on that account has concluded to give only stockholders the option of buying them. They will be payable in five years, but the company retains the privilege of taking them up in two years or more. The holders of these notes are guaranteed that at no time shall the amount of such notes exceed $300,000.

Mr. Louis W. Burnham, of the Electric Gas Lighting Company, who has passed through a year of exceptionally heavy strain, and who has not been at all strong for some time past, has determined to take a partial rest by means of an extended trip in the Southwest. While Mr. Burnham will rest for some time in Washington, Florida and the Hot Springs, he will at the same time combine business with pleasure, and will visit the important cities in Maryland, Virginia, the Carolinas, Alabama, Tennessee, Texas and all the Southwestern States, returning in about six weeks or two months, doubtless with a much increased business, and, it is to be hoped, with a good renewal of health and vigor.

Wainright Feed Water Heaters.—Among the November and December sales of the heater were the following orders:

J. A. Power, Troy, N. Y.; Canada Electric Company, Amherst-N. S.; Edison Electric Company, Pottsville, Pa.; North Attleboro Steam & Electric Company, North Attleboro, Mass.; Lewiston Electric Light Company, Lewiston, Ill.; Belfast Electric Light Company, Belfast, Me.; H. M. Sciple & Co., Huntington, Pa.; Union Electric Car Company, Beverley, Mass.; Norwalk Electric Company, South Norwalk, Conn; Marble City Electric Company, Rutland, Vt.; John Post, Jr., Boston, Mass.; Greensburg Gas Company, Greensburg, Ind.; Norwich Electric Light Company, Norwich, Conn.

Kendal & Slade have been so successful in their new enterprise of selling electric supplies that they have determined to push this part of their business more systematically, and as a valuable adjunct to their other lines of goods have taken the agency for the New York Insulated Wire Company, and will hereafter push the well-known Grimshaw wires and tapes. As they have now commodious quarters, a large and complete stock of these goods will always be found at Kendal & Slade's store, and as Grimshaw wire has long been one of the favorite wires, a large business may be expected. Kendal & Slade are also prepared to furnish cedar poles, in large numbers and on very short notice and electric light and railway companies will do well to communicate with them before ordering elsewhere.

Power from the Tide.—Patents have been issued this week in France, Germany, England, Canada and the United States, to H. B. Rankin, on a method of generating power from the tide. The inventor uses the displacement of tide water by means of a large float, held in position by cables, which, on the rising and falling tides, accumulates immense power. This method will give 16 working hours out of the 24. The power thus generated can be stored for use, by means of storage batteries or compressed air. An eminent engineer estimates, that in Boston harbor, where the tide rises 9 to 10 feet, a displacement of 15,000 cubic feet of water will give 1,140 h. p. for 24 hours. The power obtained would be converted into electricity, for lighting and for running motors for all mechanical purposes. Full information of the above can be obtained at the office, No. 54 Equitable Building, Boston.

Lightning on the Rampage.—Bostonians were treated to a rare and beautiful thunder storm this week, which occurred very unusually in the midst of a heavy snow storm. One of the lightning bolts in its path to earth was unscrupulous enough to choose an electric car "en route" and did some temporary damage, rendering it useless for the time. The other cars, however, continued to do their work nobly, and, outside of running a little behind time owing to the extremely slippery condition of the rails, weathered the storm bravely. This week an electric car on the Allston road struck and instantly killed Mr. George H. Bradford, who was riding on horseback near the track. The horse became frightened at a pile driver in the vicinity, and backed right in front of the car just as it approached, though it is claimed the car was not progressing over five miles an hour. At a public hearing by the Railroad Commissioners the West End Company have been advised to at once put on proper fenders on their cars or to reduce the speed. Fenders will doubtless be put on at once.

Bucksport, Me.—The Bucksport Electric Company, which has been making preparations for business for some time, has now got fairly under way. Mr. John Post, Jr., of Boston, is president; Mr. F. S. Palmer, of Bangor, Me., vice-president and general manager, and Mr. O. K. Stewart, of Boston, treasurer. The company own a large mill and are using an Ide self-contained engine of 100 h. p. They will manufacture cross-arms, pins, cleats, molding and all kinds of wooden work used in electric lighting, and are extremely well located for that purpose, being right in the heart of the lumber district. They are now installing a 1,000-light Thomson-Houston alternating dynamo for lighting their own mill and general electric lighting in the vicinity, and have already large demands for light. The company is already in receipt of a very large order for cross-arms, and the prospects of a good and profitable business are extremely bright.

Waltham, Mass.—The stockholders of the Waltham Gaslight Company held their annual meeting yesterday afternoon, and elected these officers for the ensuing year: Clerk, George A. Stearns; treasurer, George A. Stearns; directors, Lowell Clark, John R. Farnum, Arthur T. Lyman, A. M. Goodale, George A. Stearns, William Roberts and Augustus Flagg. The last two named take the places of M. H. Young and C. E. Getchell, resigned. The annual report of the treasurer shows that the balance on hand, Jan. 1, 1889, was $41,639.25, and the income for the year $27,631.59, making a total of $69,270.84. Out of this dividends to the amount of $8,400 were paid, interest took $1,020, insurance $388, and construction $4,142, leaving a surplus on Jan. 1, 1890, of $55,308.84. The income in 1888 was $28,419.26, or $787.67 more than in 1889. The company now has 42 arc electric lights in use for the city, and 50 for commercial purposes, beside 61 incandescent, 65 candle power, and 565 of 40-candle power.

An Insulated Trolley Wire.—Mr. E. P. Sharp, at present with the Thomson-Houston Electric Company, at Lynn, has applied for a patent on an insulated trolley wire, for which he claims there should be a large field. The insulation, which may be of any of the known insulating substances, is intended to be put on after the trolley wire is strung, and will be fastened to the wire with set screws. The insulation will be circular in section, with a groove in the lower side allowing the trolley wire to come into the centre of the insulation, and a special tongue on the trolley wheel will make the contact. The sides of the trolley wheel will bear on the outside of the insulation and serve to steady the wheel. The idea is doubtless a good one, though it remains to be seen whether it will be adopted in any great measure. Should it be adopted, it ought to put an effectual stop to any possibility of a falling wire grounding on the trolley wire, and should at least commend itself to the serious attention of electrical engineers.

Jarvis Engineering Company.—The Thomson-Houston Electric Company has ordered a special Armington & Sims 350 h. p. engine, for placing in their factory at Lynn for experimental purposes. This sale is particularly gratifying to the Jarvis Engineering Company, who have been interested in the sale of these engines from the first, and is an excellent indorsement, merited, no doubt, of the value of the Armington & Sims engine, which is noted for its close regulation and economical work. Besides this important order, it is interesting to note that Armington & Sims engines have been ordered for the Clark University, Worcester, Mass.; the Johns Hopkins University, Baltimore, Md.; the Polytechnik, Vienna, Austria; the Deutsche Edison Gesellschaft, Berlin; the University, State of Missouri; the Miller Industrial School, Batesville, Va.; the Polytechnic Building, St. Louis College, and for the Physicians and Surgeons College, in New York City. Most of these engines have been ordered for experimental laboratory work, and the indorsement by so well-known and popular institutions is of extreme value to the builders and agents of the Armington & Sims engines.

A New Electro-Mechanical Switch for Electric Railroads.—In the office of the Wheeler Reflector Company, of Boston, there is at present on exhibition a model of an electric device for operating street railway switches by induction from the moving car. The device consists of a permanent magnet laid between the tracks, which controls a local circuit, which in turn operates the mechanism in connection with the switch. This magnet is pivoted in the centre, and when one end of the magnet is attracted by the passing car, the switch is set in one direction, and when the other end of the magnet is attracted the switch is set in the opposite direction. On the car is a strong electro-magnet, the end of which can be made of either polarity at the will of the driver by turning a switch in his control. Between switches the current, of course, does not pass into the electro-magnet at all. By means of this electro-magnet either end of the permanent magnet under the surface of the street can be attracted, giving the desired effect. The device is the invention of Mr. W. D. Swart, of Boston, and is owned exclusively by Messrs. Swart and Elbert Wheeler, treasurer of the Wheeler Reflector Company, who will be glad to show the device to any one interested.

A New High Temperature Insulator.—The Gould & Watson Company have made a number of improvements in their molded mica insulators; perhaps the most important article which they have yet produced is what is called Dark Lehte, which they have lately offered as a suitable substance from which to make rosette cut-outs, switch bases, fuse boxes, and other objects which are required to stand an elevated temperature. It is well known that their Lehte, which they have been manufacturing for some time, is a most excellent insulator, and its chief application has been found in outside work, as well as in positions where it was not required to bear an elevated temperature. This Dark Lehte, which they now offer, possesses insulating qualities fully equal to Lehte, and it also may be drilled and tapped as Lehte can be. Dark Lehte has received the approval of the insurance inspectors, who have indorsed its use for the applications mentioned. This signal im-

provement in their molded mica insulators gives the Gould & Watson Company a large field to draw from, and they have already received large orders for their new material.

Boston Electric Club—Discussion on Mr. Lord's Paper on Electric Legislation.—At a special meeting of the Boston Electric Club, presided over by Mr. A. L. Rohrer, Mr. Lord's paper on electrical legislation came up for discussion. Captain Brophy was of opinion that the day was past when intelligent men claimed that there was no danger in electrical currents, but deplored the fact that companies representing high-tension currents and low-tension currents should mislead the public by decrying each other's systems in the daily press. He believed that if legislation be applied to cities it should also be applied to country towns. No local man should be put in authority, as political and party influences would be sure to bias his judgment. Mr. Denver expressed himself strongly against legislation, and pointed out that the New England Telephone Company had over 5,200 miles of wires underground in Boston, besides many miles in other cities, and this without legislation. Legislation had hindered rather than helped them up to the present. Mr. S. E. Barton, though not favoring legislation, was of opinion that some sort of commission should exist for controlling electric wires *outside* of buildings, and remarked that it was "easier to legislate than to undo legislation." Mr. Barton did not believe that there was much danger in dead wires, but believed that some safety device should be put on every small current electric wire entering buildings. Mr. Turner was of opinion that an electric commission would do much to allay the fears of the public, and make it much easier to get permission of property owners to allow the use of their buildings for electric fixtures. Mr. Ridlon spoke strongly on the subject of better construction, and maintained that good construction would obviate many of the dangers. He was glad to hear that Mr. Denver was willing to place telephone wires underground, as that would give more room for high-tension wires overhead, and more room is what was required. Mr. Ford then made a few remarks, and thought that the remarks of the gentleman only proved that there was no need of legislation. It seemed to him that the danger from wires was gradually getting less. He believed that, if a commission was necessary, the Street Railway Commission would be a good one to refer the matter to. Captain Brophy then stated that he thought the Gas Commissioners could take better care of the matter than the Street Railway Commission, and this opinion was warmly indorsed by Mr. Barton. Some discussion then took place on the advisability of bringing the paper and its discussion to the notice of the Legislature, and, on Mr. Crane's motion, the subject will be considered at the next club meeting. A. C. S.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
39 Mallers Building, Chicago, March 1, 1890.

Electric Heights is the name of a new subdivision in Denver, Col.

Mr. J. W. Chipman, of Indianapolis, was a welcome visitor in Chicago this week.

Mr. Foree Bain, Chicago, has returned from Topeka, Kan., where he was called on expert service.

Mr. F. S. Terry. manager of the Electrical Supply Company, Chicago, has gone East on a business trip.

The Oriental Construction Compan has been organized in Chicago to do a general construction business.

The Colorado Telephone Company are building a new pole line circuit from Colorado Springs to Manitou, Col.

The Electrical Supply Company, Chicago, are pushing the sale of their alcohol soldering lamps, which are valuable for interior work.

Mr. C. E. Brown, the traveling representative of the Central Electric Company, Chicago, has returned from a very successful business trip.

C. E. Hart, the promoter of the 500-h. p. electric motor and light plant about to be put in at Galena, Mo., is figuring on a similar plant for Webb City, Nev.

Mr. F. W. Horne, Chicago, has secured he contract for the complete installation of the Thomson-Houston system of electric railways at Springfield, Ill.

The Queen City Electric Light Company's plant at Dallas, Tex., was sold at sheriff's sale to the Fort Wayne Electric Company, for about $15,000.

Mr. E. M. Reed, Superintendent of the Citizens' Electric Company, Wichita, Kan., is bringing out some specialties of value in electric power and railway work.

The Monitor Electric Company succeeds to the business of G. A. Harmount & Co., Chicago. Mr. Harmount will be the general manager of the new company.

The Western Electric Co., of Chicago, are wiring the Louisville Hotel for 25 arcs and 300 incandescent 16 c. p. lamps. Mr. Sockman has charge of the construction.

The Electrical Supply Company, Chicago, have issued a neat card, holding two samples of their accurately determined fuse wire, one for 2 ampères and the other for 30.

Mr. J. J. Dickey, district superintendent of the Western Union Telegraph Company at Omaha, has been visiting Denver and other Western points on a tour of inspection.

Mr. W. B. Pearson, the Chicago representative of the Ball Engine Company, has secured two excellent contracts this week, one at Rockford, Ill., and the other in Chicago.

The Denver, Col., Tramway Company have secured the right to construct and maintain an electric railway line on Lawrence and Curtis streets extending across the city.

Mr. C. A. Ross, representing the Kansas City office of the Thomson-Houston Electric Company, made a host of friends during the convention by his kindly attentions to visitors.

The West Chicago Rapid Transit Company have secured a franchise to operate an elevated or surface street railway line by electric or other motive power, subject to certain conditions.

Geo. Cutter, Chicago, has heard from several of the unique query cards so generously distributed at the convention. It is not the first instance wherein profit has been derived from the asking of questions.

The Central Electric Company, Chicago, have added some rather unique signs within their palace of trade, among which is a large rubber floor mat, made in the form of the well-known Okonite trade-mark.

Mr. Henry Andrae, Secretary of the Milwaukee Electric Club, was in the city on Thursday en route home from New Orleans, where he attended the musical festival, which he pronounces a grand success.

Mr. M. D. Law, the well-known electrician of the Philadelphia Brush Electric Light Company, has received a very flattering offer from a Denver, Col., company, and may possibly change his headquarters, and "grow up with the West."

The Knapp Electrical Works, Chicago, are filling large orders for their special form of dry battery, which combines great strength, durability and recuperative power, and is peculiarly adapted for all heavy open circuit work.

Mr. T. F. Clohesey, who lately resigned his position as General Manager of the Interstate Electrical Company, Kansas City, Mo,, has opened an electrical engineering and construction office in the Board of Trade building, Kansas City.

The Texas State Fair and Dallas Exposition will hold their fifth grand annual entertainment at Dallas, from Oct. 18 to Nov. 2 inclusive, and a large space will be reserved in which to make a complete and interesting electrical exhibit.

The Pittsburgh (Kan.) Electric Railway Company has been incorporated with a capital stock of $50,000. Directors, B. F. Hobert, of St. Louis; A. E. Stillwell, of Kansas City; Frank Playter, B. H. Wilson, F. E. Doubleday, of Pittsburgh.

The Thomson-Houston Electric Company has dismissed the suit brought in the United States Circuit Court at Topeka, Kans., against the Topeka Rapid Transit Railway for the collection of $86,000 of the bonds of that company and the appointment of a receiver.

The Brush Electric Company, Cleveland, have commenced suit in the United States Circuit Court against the Belvidere, Ill., Electric Light Company, operating Sperry apparatus, and the Sperry Electric Company, of Chicago, to restrain infringement of patents for double carbon arc lamps.

The Knapp Electrical Works, Chicago, state that the line wire reported on in the paper on "Line Insulation," read by Mr. Charles A. Harber at the Kansas City Convention, was "Competition" line wire, and not Grimshaw white core wire, as one would be led to infer from the wording of the report.

The Westinghouse Electric Company has closed a contract with representatives of the Takata Company of Tokio, Japan, for a plant of 5,000 incandescent lamps for the town of Shidznoka. Mr. F. W. Darlington, an expert electrical engineer, will accompany the plant to Japan and superintend its construction.

The Official Badge.—Many of the delegates to the late convention feel that some steps should be taken toward officially authorizing the adoption of the beautiful silver button presented by Mr. Weeks at Kansas City as the official button of the association, to be worn at any and all times, if so desired, by the regular members of the association.

Mr. J. B. Halsted, of the Royal Electrical Specialty Company, of New York, has been in Chicago arranging with one of the prominent supply houses to handle Young's automatic safety cut-out, described in full in THE ELECTRICAL WORLD of Feb. 1, and which attracted so much attention recently at Kansas City, where Mr. Halsted was in attendance exhibiting the same.

Mr. J. W. Godfrey, general manager of the New York Insulated Wire Company, has been in Chicago several days arranging with the Knapp Electrical Works for the carrying of an even more extensive stock of Grimshaw wires than they now have, an increase rendered necessary by the extraordinary demands for Grimshaw that Mr. Knapp has created during the time he has had the agency

J. H. Siegrist, Jr., & Co., 313 Olive street, St. Louis, Mo., selling agents for the "Ideal" engines, have just sold the J. Kennard & Sons Carpet Co., St. Louis, one 10x10 "Ideal" engine to go in their new carpet house, which will be the finest in St. Louis. They have also finished erecting the second "Ideal" engine in the power house of the St. Louis and East St. Louis Electric Railroad Co. This engine is 13x12.

Toronto University was totally destroyed by fire Feb. 14. The loss is estimated at $500,000. An hour later 2,000 guests would have been in the building attending a fete. *The falling of an oil lamp caused the fire.* Insured, $164,000. Strange that the blame should have been so promptly attached to a falling lamp! Where were the electric light wires? And how large an electric plant would $164,000 have paid for?

Annual Reports.—The following named Detroit, Mich., companies have filed their annual reports with the County Clerk: Telephone & Telegraph Construction Company, capital stock, $500,000; paid in same; real estate, none; personal estate, $643,734.84; debts, $13,504.46; credits, $24,611.03. Markle Engineering Company, capital stock, $15,000; paid in, same; real estate, none; personal estate, $7,303.77; debts, $17,367.80; credits, $16,683 68.

Mr. and Mrs. J. E. Lockwood, of Detroit, and Mr. and Mrs. Candee, of New York, had a pleasant trip together, returning from Kansas City via St. Louis to Chicago, where they remained a couple of days, passing the time in visiting the more prominent points. Mrs. Lockwood heartily enjoyed the trip to Kansas City and the various attentions there received, and now is a strong advocate of the attendance of ladies at every convention.

The Chicago Suburban Belt Line Passenger Railroad and Extension Street Railway Company, of Chicago, has been incorporated to construct a suburban belt line passenger railroad to be operated by electric power, cable or dummy; also to build street railroads to connect with the belt line from terminal points now operated by street railway companies. Capital stock, $2,500,000. Incorporators, E. E. Harbert, Frank E. Barker, John A. Taylor and others.

The Electrical Supply Company's Chicago warerooms appear to be a rallying point for every out of town buyer arriving in the city, and are a paradise for the newspaper man on the lookout for stray notes. This company have recently added additional sample boards and tables on which have been placed a sample of every specialty carried in stock. Thus a station superintendent has merely to glance from one point to another in selecting whatever he may desire.

Mr. Frederick N. Bosson dined at the club rooms on Thursday, having dropped down from Ironwood, Mich., where he is engaged in installing the Thomson-Houston machinery for 6,000 incandescent lights and a large number of motors, all to be used within the mines. The lamps on the fifth and upper levels are now in the circuit and giving the best of satisfaction, and mining superintendents are carefully watching the completion of the work with the view of having a similar application of electricity made in their own mines.

Mr. S. S. Leonard, late general manager of the Minnesota Brush Electric Company, of Minneapolis, and now manager of the Western office of the Hill Clutch Works, of Cleveland, has returned to Chicago from Peoria, Ill., where he is installing a complete system of Hill shafting and clutches in what will be a model light and power station when completed. Mr. Leonard's long and extensive experience in managing one of the largest electric light and power stations in the country renders his services of particular value to all electric light companies contemplating changes, in or additions to, their stations.

H. A. & T. C. Gooch are putting in a central station plant of the Mather system on Fifth street, Louisville, Ky., the object being to supply light to the many stores in this section of the city. They have 1,500 lights wired now and expect a great many more. The plant consists of a Beck engine of 300 h. p., a Heine boiler of the same capacity with the Brightman stoker attachment; three Mather dynamos of five-hundred 16 c. p. lamps each. Mr. Gooch says he has ordered the fourth dynamo and expects it here in a few days. He also says he will be ready to furnish current for light and power about the 15th of the present month.

Telephone Quotations.—Col. S. G. Lynch, broker, 146 La Salle street, Chicago, furnishes quotations on telephone stocks as follows:

Chicago	$290@$295	Cumberland	$ 59@ $60
Central Union	58@ 59	Wisconsin	116@ 117
Michigan	97@ 99	Bell of Missouri	140@ 145
Great Southern	30@ 32	Iowa Union	23@ 25
Colorado	38@ 40	Missouri and Kansas	54@ 55
Rocky Mountain Bell	40@ 45		

ELECTRIC LIGHT STOCKS.

Chicago Arc Light and Power	$92@$94	Chicago Edison Co	$110@$112

Underground Litigation.—Charles W. Stiger and Walter C. Newhall, owners of a dynamo-electric light plant, filed a bill in the Superior Court against the Chicago Sectional Electric Underground Company, to restrain it from taking possession of underground wires used by the plaintiffs in transmitting electricity for light to subscribers on West Madison street, between Hoyne and Campbell avenues. The plaintiffs say that they leased from the defendants one hole in the conduit supposed to be in the street, but when they were ready to use it found the conduit was not laid. They laid their wires in their own pipes, and say that the defendants now threaten to appropriate them, and cancel the lease of the conduit hole. Judge Jamieson issued a temporary injunction.

Arc Light Carbons.—Mr. F. S. Terry, manager of the Electrical Supply Company, Chicago, in referring to the excellent paper on "Carbon Tests," read by Mr. E. F. Peck at Kansas City, said: "I am glad to see just such facts brought out and placed on record, as they are both interesting and instructive. I well remember the early days of the carbon trade and of the many difficulties that were surmounted at Ansonia—how we obtained $130 per thousand for the Wallace carbons, and how sorely disappointed we felt when the price fell to $78 per thousand. But even at that price we had all we could do to turn out the quantity ordered, our contract calling for 3,000 carbons per day at $78 per thousand." How comforting these figures must appear to the carbon makers of the present day.

The Detroit Electrical Works has absorbed the National Traction Company and increased its capital stock to $250,000, of which $200,000 is paid in. The works, which are now at the corner of Woodbridge and Seventh streets, will be moved to more commodious quarters to accommodate the proposed expansion of business. The officers of the consolidated company are: Hugh McMillan, president; W. A. Jackson, vice-president; W. H. Wells, secretary, and John G. Rumney, treasurer and manager. These officers and Lev Barbour, Cornelius Corbett, C. E. Warner, Frank E. Snow an Fremont Woodruff comprise the board of directors. The company is now equipping an electric street railway at Saginaw, and making experiments with a view to supplying motors for the cars of the Detroit City Railway Company.

Captain Charles Hallett, of the Hazelton Tripod Boiler Company, of Chicago, has been in Pittsburgh for the past two months carrying into effect some heavy contracts. The company which the captain represents is putting into use a boiler that entirely consumes the smoke, and in which slack coal is burned. At present Captain Hallett is placing a 500 h. p. plant for the Linden Steel Company in their works; 1,000 h. p. boilers have been put in for the Pleasant Valley Electric Road; and other contracts secured are 150 h. p. for John Robinson's Sons and 800 h. p. for the Union Storage Compamy to run their new artificial ice plant. The Pleasant Valley line has two boilers, one of which is kept in reserve, and to look at either, one can scarcely tell which is in operation. The new boilers of the Allegheny Light Company are working well.

W. C. Lyman, 48 Michigan street, Chicago, Ill., inventor of the steam condensing exhaust pipe heads, has been doing a remarkably good business lately, both for home and export trade Numerous electric light plants have been furnished with these appliances, and superintendents who have not yet investigated their merits would do well to communicate with Mr. Lyman at above address. He has lately completed a contract with the Chicago Edison Company for 16-inch exhaust pipe and attached head to outlet, the results giving good satisfaction to all concerned. A recent shipment for foreign use consisted of nine of the "A" or improved heads for use on general power plants. All heads shipped have given good satisfaction, as they all were accepted, though sent on a trial basis, and to be returned if not suitable.

The Chicago Electric Club.—The members of the club will have the pleasure of listening to an excellent paper on the preparation and management of accumulators at the next regular meeting, Dr. Paul Schoop, of the Oerlikon Works, Zurich, Switzerland having kindly offered to prepare same. At the following regular meeting, Dr. Louis Bell will read a paper "On Electric Motors in General Railroad Work," showing the economy and practicability of the transmission of heavy power over considerable distances to fast-running trains. Dr. Bell's well-known reputation for doing thorough and exhaustive work on any subject he may handle will insure a very large attendance, especially of representatives from motor companies and from electric railway companies, and a general invitation will be extended to every one interested to be present and participate in the discussion.

The Western Electric Company, Chicago, are experimenting with the "Common-Sense Fuel Saver and Excessive Steam Generator," at their large factory on South Clinton street. In the line of smoke consumers it is comparatively novel in its essential principle. The smoke is drawn out of the stack by a powerful fan and carried back under the grates again. The opening through which it is drawn from the stack is about two-thirds the area of the stack. The fan also draws in fresh air through an orifice 14 x 35 inches, with an additional opening 6 x 35 inches, to be used in case of emergency. The dampers by which air is allowed to enter the furnaces above the fire are also kept open to supply fresh air. It is estimated that about two-thirds of the smoke from the furnaces is returned and is driven through the fire again by the forced draft of the fan, the rest escaping up the stack. A 10 h. p. engine is required to drive the fans.

The India-Rubber and Gutta-Percha Company, New York, have appointed the Electrical Supply Company, Chicago, their general Western agents for the sale of all their special land and naval cores, wires, cables, and portables. Among their recent installations in the finest structures erected in New York, where Habirshaw insulation alone was specified, are the following: The Metropolitan Museum block, in Central Park, containing one of the most elaborate systems of incandescent lighting in the city, costing over $50,000, though the total number of lights is less than 3,000; the Farmers' Loan and Trust Company's new building, and the Mechanics' National Bank. The United States Government has directed that this insulation shall be used as a standard in all government work, the latest installations in the Navy where

Habirshaw was used being in the new cruisers, "San Francisco," "Philadelphia," "Baltimore," "Chicago," and others.

That Electric Train.—The Detroit *Free Press*, of recent date says: A syndicate has been formed in this city, consisting of Messrs. C. H. Smith, H. H. Humphrey and F. B. Dickerson, for the manufacture and sale of a new electric car. The motor for this car is the invention of J. F. Shawhan. * * * The car is entirely self-contained, doing away with both the overhead and underground wires, but is so constructed that it can be operated by either of those systems. The power is furnished by two motors, the batteries used being the patent of the Detroit Storage Battery Company, and consisting of 64 cells, placed in the centre of the car. They occupy considerable space, but it is claimed by those in a position to know that their weight furnishes the necessary traction to the car in rounding sharp curves, not possessed by other electrical systems. The entire car will be made and put together at the works of the Storage Battery Company, and will be ready for a public trial on the tracks of the City Railway Company in ten days, after which an effort will be made to run it over the Michigan Central tracks from Detroit to Chicago without recharging the battery.

Electric Roads for St. Louis.—With the exception of a few roads which are being run by cable, all of the street car lines of the city are getting into shape to use electricity as a motive power. The St. Louis Street Railway Company is about to close a big contract with the Sprague-Edison Electric Railway Motor Company of New York for an electric equipment for its entire road. The amount involved in the enterprise is put at $3,000,000. This contract will provide for the Broadway or old Fifth street line, and may also include the Cass avenue and Locust street roads. In addition to this the Scully roads, four in number, all starting from Fourth and Pine streets, will adopt electric motors in place of horse power immediately they obtain permission from the city government. Mr. Scully estimates that the change will cost him in the neighborhood of $1,000,000. The Jefferson avenue line will also be equipped with the new power, and the amount to be invested in electric extensions of the Lindell Company is close to $1,050,000. This will make a grand total of between $4,000,000 and $5,000,000. All of these investments depend, of course, upon the action of the Municipal Assembly in granting to the street car companies the right to change their motive power.

The Wisdom of Practical Experience —During a meeting of business men recently held in Chicago one of the prominent successful supply men of the West remarked: "It is the broad and liberal policy pursued by electrical journals that has done more than all else combined to build up the unparalleled prosperity of the electrical industries and to place them in the front rank of commercial enterprises. I am proud of the wonderful advances that have been made in electricity; proud of my connection with the commercial section of the fraternity, and prouder still of the integrity of the electrical business as a whole." The speaker is one of the most liberal of advertisers, and in referring to his very heavy expenses in that line said: "Of course it costs money to advertise, but for every dollar I have paid out I have received two—yes, sometimes ten-fold in return. But suppose the return was only sufficient to afford a fair remuneration, has not the business all along the line been stimulated, and will not somebody be benefited directly or indirectly? What first induced capital to become interested in our industries? Was it not the regular appearance each week of electrical journals full to overflowing with good solid, profitable facts and figures showing where the interest of the investor lay? And does it now require more than a single glance at the 40 or 50 pages of solid advertising matter to convince the careful investor that no other line of business is surrounded by the same healthful air of prosperity? Liberal advertising not only stimulates direct purchasing, but also stimulates hesitating capitalists into making new investments that in turn benefit all. It creates new industries and gives an impulse to the enterprise that is beyond all calculation, and is my tribute of loyalty to the business as a whole."

The St. Louis Electric Lighting Interests.—The stock interest of Hollins & Co., of New York, in the Municipal and United Electric Light companies, or the St. Louis Illuminating Company, has been sold to Ladenberg, Thalman & Co. and Seligman Bros., of New York, and Messrs. James Campbell, Mortimer F. Taylor and others interested with them in St. Louis. The Hollins people, however, retain their bonds, though this will not give them any voice in the management of the properties. The deal was closed by Mr. Campbell, who has just returned from New York, and who is president of the St. Louis Illuminating Company. The change was made necessary by the position of the people represented by Hollins & Co. Having purchased the gas properties of the city at a great cost, they invested $500,000 in the stock of the United Electric Company and St. Louis Illuminating Company, into which the former was merged, and $100,000 in the stock of the Municipal Electric Light Company. In addition, they took a number of bonds, which they still retain. With the probability of the electric light companies cutting into the trade of the gas companies, the Hollins people have not been at all anxious to place them in full operation, and used their stock interests to delay operations. This did not suit Ladenberg, Thalman & Co., Seligman Bros. and the St. Louis people associated with them, and they determined to make Hollins & Co. buy or sell. Mr. Campbell went East on this mission and found Hollins & Co. unwilling to buy and slow to sell. They argued against the Municipal, saying no money could be made on the Municipal's city contracts, which gives lamps for $75 for which other cities pay $140. The others agreed that the price was low, but maintained that by actively canvassing for commercial and private lighting the company could do a profitable business. The issue was then made very closely, and Hollins & Co. reluctantly sold, their stock being taken by Ladenberg, Thalman & Co., Seligman Bros. and Mr. Campbell, and turned over to the latter, who will have the actual management of the company's affairs. The work will be pushed rapidly, and arc and incandescent lighting contracts solicited. The change in the ownership of these interests having been perfected, it is also probable that the consolidation of the Municipal with the St. Louis Illuminating Company will be made within a short time. Arrangements are now being made for this, and the indications are that they will soon be closed. The gas people will have only the Laclede electric plant. F. de L.

Louisville, Ky., Feb. 22, 1890.

The Central Thomson-Houston Company are installing a plant at the Louisville Chair Factory.

Jeffersonville, Ind., has a Thomson-Houston plant of 53 arcs, 2,000 c. p., which began furnishing light for the city last week. The citizens speak highly of it, and would not go back to the gas lamp under any consideration.

The Louisville Jeans Clothing Company have a five h. p. Thomson-Houston motor in their factory to run their sewing machines, and Mr. Tilford says the power furnished is far superior to that of the gas engine he formerly used.

ENGLISH NOTES.

(*From Our Own Correspondent.*)

London, Feb. 15, 1890.

The Collections of Useful Electrical Data.—At the last meeting of the Electrical Trades Committee of the London Chamber of Commerce, Mr. Crompton put forth a proposal that an association should be formed for the purpose of collecting, tabulating, and distributing useful electrical data. The proposal met with general sympathy, but in the opinion of most members present the difficulty of obtaining the information required was likely to be insuperable. The experience of Mr. Allen R. Foote, on your side of the water, seems to show that while managers of electric light and power stations desire to obtain information on several points in connection with the working of stations, they by no means wish to contribute their quota of information to the "common fount of knowledge."

Multiple Resonance in Connection with Electric Oscillations.—Some experiments of MM. Sarasin and Rive on multiple resonance in connection with electric oscillations seem to show conclusively that the phenomena discovered by Hertz are much more complex than has hitherto been supposed. Hertz, it will be remembered, calculated the frequency of his oscillations from the dimensions of the primary oscillator. MM. Sarasin and Rive found, however, that they can alter the distances between the nodes and internodes without altering the primary oscillations at all, by merely employing a different resonator. It is obvious that if the waves given out by the oscillator are all of one period, the wave length should be the same, whatever the size of the resonator, although, of course, the spark distance would be lessened if the resonator was not properly timed. This discovery, although vitiating to some extent the figure for velocity of light which Hertz deduced from his experiments, in no way affects Hertz's general theory.

Mr. Kapp's Report on the Aron Meter.—Although I believe an exhaustive series of tests of various electricity meters has been carried out by third-year students at the Central Institution, no independent report has, to my recollection, been published in this country on the degree of accuracy which may be expected from electricity meters working under practical conditions A report of Mr. Gisbert Kapp on the well-known Aron meter has now been made public. The continuous current meter he found to be accurate within ½ per cent., the alternate current meter to be accurate within 1¼ per cent. The meters tested by Mr. Kapp were for forty lights and were found to register in a very satisfactory manner when only a single lamp was on. An important source of error in this type of meter came to light in the course of Mr. Kapp's tests. He found that for larger currents the constant supplied by the makers was fairly accurate, but was hopelessly wrong for small currents. This discrepancy puzzled Mr. Kapp for some time, until he discovered that when no current was on the meter steadily registered, owing to the fact that the gravity and the electrical pendulums had not been properly synchronized. One of the many reasons urged at the meetings of our parochial authorities against the introduction of the electric light in this country is that no such thing as an accurate meter exists. It is to be hoped, therefore, that Mr. Kapp's report upon this particular meter will be given every publicity.

Galvanometers.—At the last meeting of the Physical Society, Prof. W. E. Ayrton, in conjunction with Dr. W. E. Sumpner and Mr. T. Mather, read a lengthy and exhaustive paper on the subject of "galvanometers." The first point discussed was whether it was always advisable that sensitive galvanometers should be astatic; the authors were of opinion that they should be. It was then pointed out that in the ordinary method of constructing astatic galvanometers some of the most valuable portion of the coil was cut away to provide a space for the magnetic needle and mirror; an improvement would be to place the mirror outside the coil. The question of damping was next discussed, and a galvanometer devised for teaching purposes was described, in which the damping was effected by enclosing the mirror in a glass cell whose sides can be caused to approach or recede by turning a milled head. Several improvements in the methods of insulating the coils and terminals of galvanometers intended to be used for insulation tests were then referred to, a special form of instrument being exhibited, in which the copper resistance of the coils was nearly 400,000 ohms, and the shortest path along which surface leakage could take place from the coils to the base of the instrument was between 30 and 40 inches of ebonite artificially dried by sulphuric acid. The importance of having galvanometer magnets magnetized to saturation was next alluded to, and a case was cited of an instrument whose sensibility was trebled by simply re-magnetizing its needles. In conclusion, the authors stated that in their opinion the best way to make a very sensitive galvanometer with a movable magnetic system was to employ several small coils instead of one or two large ones, the magnets being horse-shoe shaped with the line joining the poles vertical. The authors also concluded from their investigations that the most sensitive galvanometer of all would be one of the d'Arsonval type, suitably modified. A valuable appendix to the paper was a table giving in a clear form a large amount of useful data relating to some 20 different types of instruments.

THE TELEGRAPH.

Several New York Bucket Shops were closed up last week, and started again almost immediately.

Boston, Mass.—The fifth annual ball of the Telegraphers' Mutual Aid and Literary Association was given last week, and was an unqualified success.

Pine Bluff, Ark.—The Pine Bluff District Telegraph and Fire Alarm Company has been incorporated, with John R. Lebasquet, president; Lee Weed, vice-president, and J. B. Richards, secretary. The capital stock is $10,000.

Postal Telegraphs.—Mr. Wade, of Missouri, has introduced in the House of Representatives a government postal telegraph bureau, under the fourth postmaster-general, and providing for work on a 10 cents for 20 words basis. Postmaster-General Wanamaker and Mr. Chandler have been heard by the House Post Office Committee.

Commercial Union Telegraph Company.—The annual meeting of the Commercial Union Telegraph Company of Maine, was held at Portland, Me., on Feb. 12. The following directors were chosen: Col. H. S. Osgood, Portland; Henry Russell, Albany, N. Y.; F. N. Dow, Portland; Albion Little, Portland; E. J. Slattery, Albany; S. R. Small, Portland; I. W. Wakefield, Bath; C. E. Arnold, Albany; G. C. Wing, Auburn; W. D. Pennell, Lewiston. The board organized with Col. H. S. Osgood as president; Hon. Albion Little, treasurer, and S. L. Larrabee, clerk.

THE ELECTRIC LIGHT.

Cordele, Ga.—The United Edison Company will put in a plant.

Crisfield, Md.—L. R. T. Dixon is interested in an electric lighting project.

Chattanooga, Tenn.—F. H. Woodworth wants estimates on a hotel plant, etc.

Marion, S. C.—The Marion Cotton Mill Company has been putting in a plant.

Radford, Va.—The Central City Electric Light Company has been incorporated.

Anderson, S. C.—The Anderson Hotel Company will put in an electric light plant.

Macon, Ga.—The Macon Brewing Company proposes to put a plant in its brewery.

Nashville, Tenn.—Falconnet & Hogan want some small arc and incandescent motors.

Tuscumbia, Ala.—The Tuscumbia Electric Light Works are putting in a new dynamo.

Knoxville, Tenn.—The Knoxville woolen mills want an incandescent dynamo for 500 lights.

Princess Anne, Md.—Mr. L. R. T. Dixon wants to get bids on a plant of 1,000 incandescent lights.

Mt. Sterling, Ky.—The city has awarded contract for its plant to the Thomson-Houston Company.

Owenton, Ky.—A. M. House is organizing a local company to put in a Thomson-Houston plant.

Big Stone Gap, Va.—The Big Stone Gap Electric Light and Power Company is to be incorporated.

Louisville, Ky.—The Gooch Electric Company has asked for permission to put its wires underground.

Brunswick, Ga., desires better street lighting and the immediate installation of a fire-alarm system.

Shelby, N. C., proposes to issue $1,800 of bonds to secure the establishment of an electric light plant.

Crisfield, Md.—L. R. T. Dixon, of Princess Anne, is forming a local company for incandescent lighting.

Bessemer, Ala.—A. Stein has bought the Bessemer electric light plant for $8,900, and will improve it.

Baltimore, Md.—The Wise Bros. Manufacturing Company have been putting a plant in their factory.

Clifton Forge, Va.—It is proposed to incorporate the Clifton Forge Electric Light and Power Company.

Gadsden, Ala.—P. H. Harralson, of Atlanta, is organizing a company to put in an electric and gas plant.

Searcy, Ark.—W. F. Carter and others contemplate putting up a plant with capacity for 300 incandescent lights.

Natchez, Miss.—The Natchez Gas Light Company have put in an additional engine and Thomson-Houston machine.

Grafton, W. Va.—A. R. Campbell has submitted a proposition from a local company to light the town by electricity.

Piedmont, W. Va.—The Piedmont Electric Illuminating Company will issue bonds for $40,000 for enlargements.

Big Stone Gap.—It is reported that the Big Stone Gap Improvement Company will put in an electric light plant.

Luling, Tex.—The erection of an electric light plant is proposed. The mayor can give information on the subject.

Millvale, Pa.—The Millvale Electric Light, Heat and Power Company has been formed with a capital stock of $10,000.

Salem, Va.—E. A. Parsons and others have incorporated the Salem Electric Light and Power Company. He is president.

New Orleans, La.—It is reported that Heath, Schwartz & Company, Ltd., will put in an electric light plant during the summer.

Milwaukee, Wis.—The Union Labor Party is in favor of a municipal plant for lighting, and proposes to work and vote that way.

Yorkville, S. C.—Mayor J. F. Hart is open to communications in regard to an electric light plant, in conjunction with water works.

Susquehanna, Pa.—The Susquehanna Electric Light, Heat and Power Company has been formed with a capital stock of $20,000.

The Westinghouse Electric Company has installed a 750-light plant, alternating current system, at Sioux Falls, South Dakota.

Johnson City, Tenn.—The Johnson City Electric Light and Power Company has amended its charter, increasing the capital stock to $10,000.

Birmingham, Ala.—The Birmingham Gas and Electric Light Company will probable consolidate with the Birmingham Union Railway Company.

Benicia, Cal.—The Benicia Electric Light and Motor Company have decided to build a station and equip it with engines, boilers, dynamos, batteries, etc.

Cordele, Ga., proposes to have its own electric light plant, and to supply current to private consumers. Councilman D. J. McRae has the matter in charge.

Perth Amboy, N. J.—C. L. Leary, the receiver of the Perth Amboy Electric Light Company, is to sell the company's plant for the benefit of the creditors.

Randleman, N. C.—The Randleman Manufacturing Company has put a 75-light plant in its C. C. Randleman mill and a plant of 150 lights in the Plaidsville mill.

Freeport, Ill.—The arc and incandescent light plant owned by Farwell & Munn, at Freeport, Ill., was destroyed by fire last week. Loss, $25,000; insurance, $3,000.

Hopkinsville, Ky.—The exclusive franchise for 20 years, for electric lighting and electric railways, granted S. H. Turner, has been repealed so far as relates to the exclusiveness.

Pineville, Ky.—The Westinghouse Company have been awarded a contract by the new local company for a plant comprising a 25 arc light dynamo and two 500 incandescents.

Williamsport, Pa., has now an electric light plant of a capacity of 2,250 incandescent lamps. A new 750-light machine, Westinghouse alternating current system, has just been added.

Petaluma, Cal.—The Petaluma Electric Light and Power Company have bought from Mr. S. H. Taylor a Thomson-Houston plant of 50 arcs and 650 alternating incandescents.

New Cumberland, W. Va.—The new Cumberland Light Heat and Power Company has secured a city contract, and will now put in its proposed arc and incandescent plant.

Cleburne, Tex.—W. H. Gaston, of Dallas, and Max Elser, of Fort Worth, have purchased the Cleburne electric light plant for $4,575, and will probably enlarge and improve the same.

Kimball, Tenn., is a new town and it is reported that an electric light plant will grace the scene. The New York & New Orleans Coal and Iron Company, of Chattanooga, is interested.

Independence, Ore.—The Independence Water and Electric Light Company has been formed by H. Hershner, A. J. Goodman, H. H. Jasperson, A. Nelson and J. Donsike, with a capital stock of $40,000.

Pueblo, Col.—The Bessemer Gas and Electric Light Company of Pueblo, Col., has been formed with a capital stock of $100,000. J. A. Dempsey, Rees Jones and H. Tritch are the directors for the first year.

Fort Worth, Tex.—The central station electric light plant, Westinghouse alternating current system, at Fort Worth, Texas, has increased its capacity by the addition of a 750-light Westinghouse dynamo.

Stern & Silverman, of Pittsburgh, write us that the Carnegie Library Building, in Allegheny City, will not have a Westinghouse plant as stated, but that the library was wired by the Edison agents, and will be lighted from the Allegheny City plant.

Kentucky has hitherto been considered a very poor field for the progress of electric lighting. A few days ago, however, the Westinghouse Electric Company was awarded the contract for a 3,000-light plant of the alternating current system in Lexington.

Nashua, N. H.—A $80,000 plant will be erected in this city this summer to accommodate the large increase in electric lighting. A new brick building will be erected and a three-acre lot has been secured for that purpose, the old station being used for a street electric railway power station.

The Binghamton, N. Y., Gas and Electric Company, of Binghamton, N. Y., has increased its electric lighting plant by the addition of Westinghouse alternating current apparatus of 750 lights capacity. The Binghamton station will now have a total capacity of three thousand lights.

Nashua, N. H.—The National Gas & Electrical Construction Company was organized at Nashua, N. H., Tuesday of last week. Directors, George H. Drew, Frederick M. Smith, Edward F. Houghton, Linus M. Child, Fred J. Hutchinson, all of Boston. Fred Whittemore of Nashua, is clerk.

Savannah, Ga.—The alternating current central station at Savannah, Ga., has for some time been overrun with business, which has necessitated additional facilities. A contract was made a few days ago with the Westinghouse Electric Company for a 750 light machine. This gives the plant a total capacity of 3350 incandescent lights.

Baltimore, Md.—A bill has been introduced in the Legislature at Annapolis to incorporate the Hampden & Waverly Electric Light and Power Company, with John W. Clark, A. Gottschalk, George W. Sadtler and others as incorporators, to supply electric light and motive power for Baltimore City and County. The capital stock is $1,000,000.

The Trial for Manslaughter.—The trial of J. W. Pierce superintendent of the Brush Electric light Company, of this city, who was indicted for manslaughter, for the death of the salesman, Harris, in Eighth avenue, who was killed by an electric wire, was set down for Feb. 18 in the Court of General Sessions. On motion of counsel it was adjourned.

St. John, N. B.—Mr. George F. Calkins, agent for the maritime provinces of the Brush Electric Company, reports that he has sold to Messrs. D. W. Clarke & Sons of that city a 45-light Brush arc plant to replace the one recently destroyed by fire. Messrs. Clarke & Sons have been so well satisfied with their old plant that they did not ask for any outside quotations.

Austin, Tex.—The survey of the water power in the Colorado River, lately mentioned, says the Baltimore *Manufacturers' Record*, is being made by the city with a view to using it to operate an electric light plant and water works. The matter has yet to be submitted to a vote of the people before anything can be done. John McDonald, mayor, can give information.

Butte, Mont.—Electric lighting is rapidly gaining favor in Butte, Mont. Scarcely a year ago a company was organized in that place, a plant was established, and one 750-light dynamo, Westinghouse alternating current system, installed. Since then, the demand upon the company has been so great that the capacity has been twice increased, and the central station has now three 750-light machines running at full load.

Asheville, N. C.—The contract for lighting the city having about expired, the council have determined to let out the contract for the ensuing year to bidders: and if satisfactory arrangements cannot be agreed on in that way, the council intend to put up and control their own apparatus for lighting the city. They have come to the conclusion that the city should own and control the lights as well as the water supply.

Cincinnati, O.—The Cincinnati Electric Light Company held its annual meeting for organization last week. The election of directors resulted as follows: A. Hickenlooper, Robert Allison, W. A. Goodman, S. J. Broadwell, N. G. Keenan, E. V. Brookfield and Charles H. Law. At the organization of the board subsequently General Hickenlooper was chosen president, Mr. Faust secretary, and C. F. Hesser manager.

Lebanon, Ky.—The Lebanon Electric Light Company, with a capital stock of $20,000. started up on Feb. 20. The plant is of the Thomson-Houston arc system, at 1,100 volts, running at 1,500 revolutions, driven by a 50 h. p. automatic 10x12 engine from the Taylor Manufacturing Company. The company is putting half a dozen lights along the streets, among the contract gas lamps, as an advertisement, and the prospects for business are excellent.

Westinghouse Alternating Plants.—Among the contracts for alternating current apparatus for central station lighting obtained by the Westinghouse Electric Company during the first two weeks of February are noticed the following: Williamsport, Pa., 750 lights, increase; Butte, Mont., 750 lights, increase; Fort Worth, Tex., 850 lights, increase; Sioux Falls, Dak., 750 lights; Pineville, Ky., 500 lights; Lexington, Ky., 3,000 lights; Creston, Ia., 750 lights; Shidznoka, Japan, 1,500 lights.

Sing Sing, N. Y.—The old method of furnishing electric light to consumers on the contract system is rapidly becoming a thing of the past, superseded by the meter system, which strongly appeals to the consumer by its features of equity and economy. One of the companies which has recently adopted the meter is the Sing Sing Electric Lighting Company, Sing Sing, N. Y., which announces that it is prepared to furnish its customers the Shallenberger alternating current meter of the Westinghouse Company.

A New Electric Light and Water Gas Combination.—It is noted in the Boston *Evening Traveller* of the 7th that a new syndicate has been formed, comprising some of the leading fuel gas and electric interests in combination, for the purpose of installing plants, and a charter is now being carried through the Canadian Parliament granting privileges for their objects. It is understood that the same parties have in view the establishment of fuel gas plants in some of the thickly populated cities near to Boston, including Cambridge, Woburn, etc.

Athens, Ga.—Mr. J. T. Robinson, manager of the National Oscillating Steam Pump Company, Atlanta, Ga., writes us: "We are thoroughly overhauling and adding to the gas works at Athens, and are putting in and have completed an electric plant. It consists of a nice substantial brick building, with over 200 h. p. improved Ball engine and latest improved boilers, of steel, extra thick, with every possible steam improvement. Owning seven acres of land down to the river front, we can set in our own water works, with double tank capacity and pressure for the entire plant. We now have our full capacity of arc lights and incandescents, including a city street contract. The city has accepted the lights. We use the Thomson-Houston system."

Nashville, Tenn.—The Capital Electric Company, mentioned in last issue, says the Baltimore *Manufacturers' Gazette*, as probably to consolidate with the Nashville Lighting and Power Company, has purchased the plant and franchises of that company for $60,000, and, will, it is stated, increase its capital stock from $75,000 to $200,000 to make proposed improvements and furnish working capital. It contemplates, it is said, erecting a building 180x100, and boiler house 50x120 feet, and equipping with two 1,500 h. p. Corliss engines and about 24 dynamos, also generators and motors, increasing the capacity of the combined plants from 200 arc to 600 arc lights and 3,000 incandescent to 6,000.

Westinghouse Plant for Boston and New York.—The machinists in the Westinghouse Electric Company's works, Pittsburgh, Pa., are rapidly hurrying the dynamos for the Boston arc light plant toward completion. The contract calls for 650 lights, for which electricity is to be generated by 11 dynamos, 60 lights each, of the new Westinghouse arc light system; four machines have been shipped already and the others will follow within a few weeks. The Westinghouse Electric Company is also furnishing a new arc light outfit to the United Electric Light and Power Company, of New York City. Ten 125-light arc machines of the new alternating system have been ordered, one of which has been shipped. The remainder will follow as soon as possible.

How a Lineman's Life was Saved.—Newton D. Harsh, an electric lineman in the employ of the electric light company in Lancaster, Pa., went through a thrilling experience on Feb. 15. He had climbed to the top of a pole from which the wires had been removed and was sitting on one of the cross pieces, when Superintendent Shoemaker, who was mounted on another pole fifteen feet distant, saw that the other pole was shaking and about to fall with young Harsh on it. Quickly realizing the situation, the superintendent did the lasso act with a rope which he held. With an accuracy worthy of a Western cowboy he caught the falling pole in the nick of time, and while he held desperately to the rope, letting it out gradually, young Harsh clung to the pole and reached the ground safely.

APPLICATIONS OF POWER.

Tacoma, Wash.—Mr. A. C. Mason is interested in a storage road now being built.

Astoria, Ore.—The new electric road will be about 3½ miles long, and will cost about $50,000.

Middlesborough, Ky., is to have an electric road, for which arrangements have already been made.

Houston, Tex.—In extending its system, the Houston City Street Railway Company will adopt electricity.

Shreveport, La.—The Shreveport Railway and Land Improvement Company will put in a Thomson-Houston plant.

Galveston, Tex.—A dispatch from Galveston credits a Denver syndicate with the intention of putting in an electric road there.

Lexington, Ky.—The Lexington City Railroad Company has contracted with the Sprague Company for an electrical equipment.

St. Augustine, Fla.—It is said that Mr. T. W. Wrenne, of Nashville, Tenn., has advanced $30,000 for the purpose of putting in an electric road.

Dallas, Tex.—The Dallas Electric Railway Company has been incorporated, with a capital stock of $200,000, by H. C. Gilbert, R. S. Vivian, H. C. Burley, W. C. Currie and J. M. Dickson.

Lititz, Pa.—A company has been formed by the citizens of Lititz to build an electric road from that place to Lancaster, a distance of eight miles. B. M. Stauffer has been elected president, and J. Miller secretary of the preliminary organization.

Augusta, Ga.—The Augusta Railway and Investment Company and the Richmond County Belt Line have been bought by S. M. Jarvis, R. M. Spivey and D. B. Dyer, all of Kansas City, who, it is said propose building 15 miles of electric or cable railroad.

Richmond, Va.—It is proposed by J. M. Fourqureau, J. T. Redd, Jr., and others, to incorporate the Brookland Railway and Improvement Company in Henrico County, with a capital stock not to exceed $100,000, and to operate by electricity or horses.

Utilizing the Potomac Falls.—It is proposed, says the Baltimore *Manufacturers' Record*, to use the Great Falls of the Potomac river, 16 miles above the city, to force compressed air to the city to operate electric-light plants by pneumatic power. General B. F. Butler can give information if anything is done.

Fairhaven, Wash.—The Fairhaven Electric Railway Company has been formed by N. Bennett, C. N. Larrabee, J. F. Wardner, E. M. Wilson, P. Evans, H. G. Thompson and G. A. Black with a capital stock of $250,000, and with the intention of building a road through several contiguous places in the State of Washington.

Ashland, Wis.—Several electric motors of a new pattern have been manufactured at the Superior Machine Shops, Ashland, by ex-city Treasurer Wm. S. Beeman, and the test made recently proves, it is claimed, that the motor can be manufactured at a cost of about $10 each on Mr. Beeman's plan. A stock company will probably be formed to manufacture the motors.

An Electric Road in France.—The recently-opened electric tramway connecting Clermont-Ferrand with Royat is only a mile and a half long, but on it are thirteen stations. The generating plant comprises a 150 h. p. Farcot engine and a six-pole separately-excited Thury dynamo, giving 350 ampères and 300 volts at 375 revolutions. The current is taken to the cars by an overhead conductor, the rails acting as return. Each car is driven by a 40 h. p. Thury motor. The normal speed is eight miles an hour.

Sims-Edison Electric Torpedo Company.—The annual meeting of the stockholders of the Sims-Edison Electric Torpedo Company has resulted in electing these officers: President, Everett Frazar; first vice-president, Hector de Castro; second vice-president, Gardiner C. Sims; secretary, George W. Casper; treasurer, W. M. Deen; general manager, W. Scott Sims; consulting electrician, Thomas A. Edison; consulting engineer, Gardiner C. Sims; trustees, Thomas A. Edison, Charles Batchelor, Gardiner C. Sims, Everett Frazar, W. M. Deen, W. Scott Sims, Ambrose Snow, Hector de Castro and George W. Casper.

PERSONALS.

F. A. Scheffler, formerly superintendent and general manager of the Erie City Iron Works, of Erie, Pa., has accepted the position of acting general superintendent of the Westinghouse Electric Company, of Pittsburgh.

Mr. T. A. Edison is reported to be at work on an apparatus for photographing a speaker who is using the phonograph, so that the two "records" may be reproduced together. Mr. Edison is said to have already a number of successful dual reproductions of this kind.

Mr. Frederic Nicholls, manager of the Toronto Incandescent Electric Light Company, delivered an address recently before the Canadian Association of Marine Engineers, in Shaftesbury Hall, that city, on "The Dynamo Electric Machine and the Electric Motor."

Prof. W. D. Marks delivered a lecture on February 19, in the Friends' Institute Lecture Course, Philadelphia, on "The Practical Applications of Electricity." It was profusely illustrated with beautiful experiments, and was heard with the closest attention by a large audience.

Mr. E. W. Bates, who was in charge of the Thomson-Houston exhibit at the Melbourne, Australia, Exhibition in 1888, and later connected with the Thomson-Houston exhibit at the Paris Exhibition, has left for Cardenas, Cuba, to take charge of the local electric lighting company operating the Thomson-Houston system.

Mr. Lemuel Wm. Serrell, who has recently opened an office at 115 Broadway as consulting and constructing mechanical and electrical engineer has just issued a neat little pamphlet, pocket size, containing a number of valuable data and rules relating to electric lighting, power, street railways, etc. Mr. Serrell's experience makes him eminently well fitted for the work he is engaged in.

Mr. C. V. Boisot, who is representing the Edison interests in the Argentine Republic, had the satisfaction of winding up the old year and beginning the new with starting up and turning over the plant of the Sociedad Co-operativa Illuminacion Electrica de Almirante Brown at the suburb of Adrogue. The occasion was made one of social festivity, and Mr. Boisot was presented with an album containing an autographic testimonial from the stockholders of the company.

Mr. G. Lockemeyer, of Seattle, W. T., sends us a very interesting letter relative to the revival of electrical interests in that city since the great fire. Electric lighting is rapidly on the increase, and the electric road is in excellent shape, giving satisfaction and earning money, besides opening up beautiful suburbs. Mr. Lockemeyer says that every town of good size in Washington and adjoining country will invest in electric roads. The electric lighting interests in Seattle are the Seattle Gas and Electric Company, with 250 Thomson-Houston and American arcs; Seattle Electric Light Company, with 50 Thomson-Houston arcs and 100 more going in; the Edison Company with 1,600 incandescents; and the Commercial Electric Light Company with 100 Waterhouse arcs and about 1,000 Westinghouse alternating incandescents.

MISCELLANEOUS NOTES.

The Kirwan Electric Station Indicator Company, of Scranton, Pa., has been formed with a capital stock of $25,000.

The Johnstown Electric Train Signal Company has voted to sell enough stock at $5 per share to equip a factory for the manufacture of its signal apparatus. It has a capital stock of $500,000 in shares of $10.

Washington, D. C.—Superintendent Miles, of the District telegraph and telephone service, finds that it will cost $30,700, more than the $250,000 of the original estimate, previously reported, to place the telephone and fire-alarm wires underground, and recommends the adding of this sum.

Electric Legislation.—Assemblyman Whipple is introducing a bill at Albany providing that anybody operating currents "the pressure of which is greater than 250 volts" for light and power "shall use and maintain such safeguards and devices upon each and every circuit as will protect life and property against injury by the breaking or disconnecting of said high tension electric wires;" the act to take effect June 1, 1890.

Beattie Battery Zinc and Electrical Company.—The stockholders of the Beattie Battery Zinc and Electrical Company have received circulars stating that it is necessary to raise $30,000 with which to pay the indebtedness and leave a sufficient sum in the treasury to admit of starting operations at the factory, which have been suspended for a considerable time. To raise this amount it is proposed to put upon the market 30,000 shares of the capital stock at $1 a share, and the stockholders are urged to subscribe. The circular says, "if sufficient funds are raised in this way, it is believed that the business of the company can be largely increased.' The circular is signed by Benjamin Cook, Howes Norris and Arthur Lord, of the board of directors.

BUSINESS NOTICES.

Henry R. Worthington has recently received from one party an order for 10 Worthington independent condensers. Each condenser is to be used with an engine of 700 h. p., thus making a total of 7,000 h. p. in one plant. This firm is at present supplying several electric light stations with their condensing apparatus.

Battery Cut-Out.—Attention is called to a simple device for disconnecting gas lighting batteries if accidentally grounded. It is cheap, sensitive, never needs watching, and has no clockwork to be kept wound. Terms furnished by the Electric Supply Company, of Syracuse, N. Y., No. 105 South Warren street.

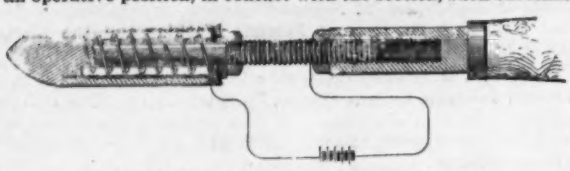
The Finest on Earth.—The Cincinnati, Hamilton & Dayton Railroad is the only line running Pullman's perfected safety vestibuled trains, with chair, parlor, sleeping and dining car service between Cincinnati, Indianapolis and Chicago, and is the only line running through reclining chair cars between Cincinnati, Keokuk and Springfield, Ill., and combination chair and sleeping cars from Cincinnati to Peoria, Ill. It is the only direct line between Cincinnati, Dayton, Lima, Toledo, Detroit, the Lake regions and Canada. The road is one of the oldest in the State of Ohio, and the only line entering Cincinnati over 25 miles of double track, and from its past record can more than assure its patrons speed, comfort and safety. Tickets on sale everywhere, and see that they read C., H. & D., either in or out of Cincinnati, Indianapolis or Toledo. E. O. McCormick, general passenger and ticket agent.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

U. S. PATENTS ISSUED FEB. 11, 1890.

420,936. Electric Body-Battery; Oliver S. Hall, of Marion, Iowa, Assignor of one-half to James M. Gray, of same place. Application filed June 26, 1889. A cover composed of flannel or like material formed into a rectangular shape, having a central longitudinal seam dividing it into two open-ended compartments, the cover being lined with water-proofed material, and also provided at its upper end with a flap having a suitable button hole for engaging a button on the face of the cover in combination with a galvanic belt consisting of a chain of alternating copper and zinc discs, having interposed felt discs.

420,954. Electro-Magnetical Movement; Samuel E. Nutting, of Chicago, Ill., Assignor to the Nutting Electric Manufacturing Company, of same place. Application filed March 12, 1889. In an electro-mechanical movement, the combination of an electric circuit, a section of which is heated by the passage of a current of electricity, a softening substance adapted to harden in an operative position, in contact with the section, such substance



No. 421,185.—Electric Soldering Iron.

and section being held in fixed relative positions to each other until the section is heated, and means for changing their relative position as the substance is softened by the heating of the section.

420,955. Electro-Mechanical Movement; Samuel E. Nutting, of Chicago, Ill., Assignor to the Nutting Electric Manufacturing Company, of same place. Application filed April 29, 1889. In an electro-mechanical movement, the combination of an electric circuit, a heat conductor to which heat is imparted by the circuit, a disc or cylinder of softenable substance in contact with the heat conductor, such disc or cylinder and conductor being held in fixed relative positions to each other until the conductor is heated, and means for rotating the disc or cylinder as the substance of the disc or cylinder is softened by the heating of the conductor.

420,964. Electric Vote Indicator and Recorder for Legislative Bodies; William Henry Robinson, of Rochester, N. Y. Application filed Oct. 28, 1886. An indicator, consisting of a suitable tabular frame provided with a series of name spaces and a series of indicating spaces corresponding thereto, each name-space carrying a fixed name, and each indicating space being provided with a movable indicating shutter, and an electro-magnet provided with circuit connections for controlling the movement of the shutter.

420,975. Storage Battery; Charles Sorley, of New York, N.Y., Assignor to the Anglo-American Electric Light Company, of West Virginia. Application filed November 12, 1889. The invention consists in the combination of the electrodes with the supporting bridge-pieces of non-conducting material, with the interposed supporting and spacing bars of like material, and with the means for clamping the various parts into a united body. See illustration.

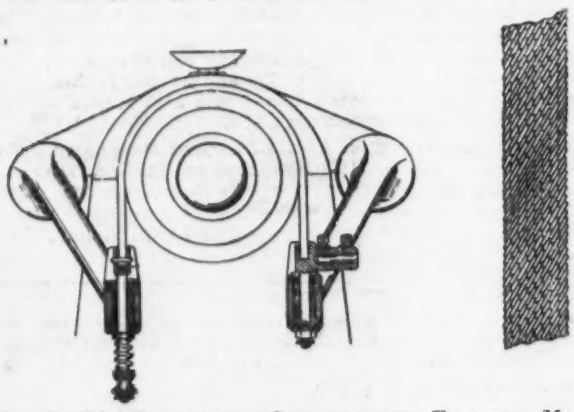
420,984. Lightning Arrester; George G. Bayne, of Fremont, Neb. Application filed Oct. 1, 1889. In a lightning arrester, the combination of a series of binding posts, fusible wires connecting the binding posts with an arrester-plate, an electrical conductor, connecting one of the binding posts with the line wire, springs coiled upon each of the remaining binding-posts, arms extending outwardly from the springs, and having cranks at their outer ends and insulating sleeves mounted upon the cranks.

421,006. Telephone Transmitter and Receiver; Hosea W. Labbey, of Boston, Mass. Application filed July 1, 1885. Double magnets, the two parts being hinged together at the open ends, in combination with the adjusting rods and thumb screws.

421,011. Attachment for Telephones; George F. Newland, of Detroit, Mich. Application filed Sept. 28, 1889. The combination, with a telephone signal bell located on a hinged door, of a clutch or holder also located on the door and adapted to engage the clapper, the clutch constructed to engage the push button as the door is closed, whereby it may be operated by the act of pressing the button.

421,048. Regulator for Dynamos; Edward Heymann and Frank William Heymann, of Boston, Assignor to James E. Maynadier, of Taunton, Mass. Application filed June 10, 1889. The regulator, consisting of the regulating coils about the armature and the variable resistance, the coils and the resistance being in a shunt around the main circuit and combined with the dynamo and its main circuit. For description see p. 178.

421,053. Thermo-Electric Resistance Regulator; Samuel E. Nutting, of Chicago, Ill., Assignor to the Nutting Electric Manufacturing Co., of same place. Application filed Aug. 16, 1889. The combination of an electric circuit, a spring coilable or uncoilable by the agency of heat, a resistance coil, and a current



No. 421,320.—Collecting Contact for Electric Machines.

conductor connected to a spring and conveying a current of electricity to the resistance coil and moved to different positions on the coil as the spring is coiled or uncoiled.

421,067. Art of Making Cores for Electro-Magnets; Stanley Charles Cuthbert Currie, of Philadelphia, Pa., Assignor to the United Electric Improvement Co., of Gloucester City, N. J. Application filed June 1, 1889. A core for a magnet composed of iron filings, chips, or shavings, silicate of soda, and asbestos.

421,081. Galvanic Battery; Jacob F. Mehren, of Chicago, Ill. Application filed Nov. 19, 1889. A receptacle for a battery cell, having terminals extending laterally from the body of the receptacle and formed each into a part of an interlocking joint between cells, whereby the cells may be connected immediately by interlocking their opposite terminals.

421,088. Conduit for Electric Cables; William P. Tyler, of Boston, Mass. Application filed Sept. 18, 1889. The conduit consists of a series of tubes joined together, the edge of each tube being expanded into an outwardly projecting flange, which flange is curved on the inside where it joins the tube, so that no portion of the conduit will present a sharp edge to the cable.

421,090. Starting Switch for Electric Motors; William A. Anthony, of Manchester, Conn., Assignor to the Mather Electric Company, of same place. Application filed March 21, 1889. In an electric switch, the combination of an arm and its contact point with another arm and a plurality of contacts thereof, the upper surfaces of the last-mentioned contact points being on one plane and the upper surface of the first-mentioned contact point being on a higher plane.

421,114. Switch-Board; William M. Stewart, of Schenectady, N. Y. Application filed June 21, 1889. The invention consists of a switch having two switch levers connected by a spindle, but insulated therefrom, each lever having a long and a short arm and having contact points adapted to be engaged by the long arms and short arms, the contacts being arranged in two concentric circles upon either side of the board.

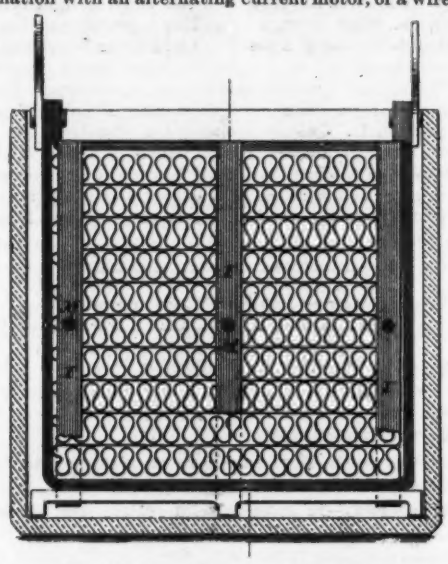
421,169. Electric Battery; Ernest M. Gardner Hewett, of Newton, Mass., Assignor, by direct and mesne assignments to the Safety Electric Light Co., of Maine. Application filed June 29, 1889. The invention consists in enlarging the holes for the pencils at the under side of the cover, so as to form annular pockets around the pencils, the pockets being filled with any suitable cement which will resist the chemicals used in the battery and prevent them from working through the cover and around the pencils.

421,177. Safety Device for Electric Currents; Hermann Lemp, of Lynn, Mass., Assignor to the Thomson-Houston Electric Company, of Connecticut. Application filed June 14, 1889. The invention consists in the combination, with a series of translating devices placed on an electric conducting wire leading from one pole to the other of an electric source, of an automatic disconnector at each terminal or pole of the metallic portion of the line circuit, including the translating devices, and an electro-magnet for each disconnector.

(1) 421,179. Cut-out. (2) 421,180. Thermal Cut-out; Everett W. Little, of New York City, N. Y. Applications filed (1) November 19, 1889. (2) November 22, 1889. (1) The invention consists of a base having a circular cavity in its face, the walls of which are notched to form a ratchet, the alternate teeth of the ratchet being faced or armed with metallic contact plates, against which a pair of movable contact plates telescoping at each end may be brought to complete a circuit, or by a further movement of the contacts to break the circuit. (2) The invention consists of a block of insulating material, into the ends of which conductors project and are secured, the block being provided with a spiral groove on its surface, in which is placed the fusing strip connected from one conductor to the other. See illustration.

421,185. Electric Soldering Iron; Willard M. Miner, of Plainfield, N. J. Application filed Nov. 5, 1889. The invention consists of a solid head of copper, in combination with a heating resistance placed on the outside and surrounding the same. A shell of non heat-conducting material is placed over the resistance to concentrate the heat upon the copper and to prevent its dissipation. See illustration.

421,193. Transmission of Power by Electricity; Edwin Wilbur Rice, Jr., of Lynn, Mass. Application filed July 26, 1888. In a system of power distribution by alternating currents, the combination with an alternating current motor, of a wire or main,



No. 420,975.—Storage Battery.

carrying continuous currents, and a motive-power device operated by the continuous currents and connected to the alternating current motor, for bringing the alternating current motor to speed.

421,195. Motor for Electric Regulating Apparatus; Friedrich Ross and Asmus Franzen, of Vienna, Austria-Hungary. Application filed Oct. 20, 1887. In an electromotor, the combination, with an electromagnet, of a smooth-faced reciprocating rod and a single armature spanning both poles of a magnet and provided with pivotal gripping jaws and restraining-springs, whereby, as the armature is attracted toward its magnet, the rod will be grasped or gripped and moved in the same direction.

421,207. Cut-Out for Incandescent Lamps; Elihu Thomson, of Lynn, Mass. Application filed Jan. 27, 1888. The invention consists in controlling the shunting or cut-out switch by means of an electro magnet having a coil connected to a normally-closed supplemental circuit in the shape of a conductor which is located within the lamp or in suitable proximity to the portion of the apparatus liable to breakage, so that the electric arc formed on rupture of the conductor may, by its heat, rupture the supplemental conductor, and thereby bring the switch into action. See illustration.

421,208. System of Distribution for Alternating Currents; Elihu Thomson, of Lynn, Mass. Application filed Feb 4, 1889. The combination, with the same constant potential source, of a transformer whose secondary supplies a constant current circuit, having electric lamps or other final-energy users in series thereon, and a transformer whose secondary supplies translating devices arranged in multiple arc, the primaries of both transformers being supplied in multiple from the source

421,214. Telegraphic Sounder; George Washington White, of Huntsville, Ala. Application filed Sept. 24, 1889. The combination, in a telegraphic sounder, of the electro-magnets having their coils connected, and the line-wires having the magnets in circuit, with two sets of screws mounted in an adjustable metallic curved frame arranged between the magnets, the vibratory sounder bar having its upper arm standing between the points of the screws and the armature secured to the sounder-bar.

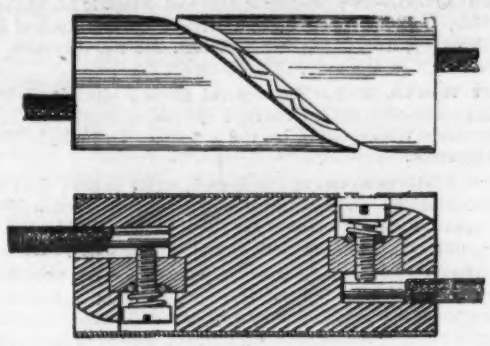
421,222. Commutator for Dynamos, Motors, etc.; George H. Alton and William O. Wakefield, of Lynn, Mass., Assignors to the Thomson-Houston Electric Co., of Connecticut. Application filed March 8, 1889. The invention consists in providing the commutator segments or strips at their ends with both an outer and an inner bevel, and in clamping the segments by devices adapted to grasp and clamp the outer and inner bevels of the ends independently.

421,239. Railway Electric Signal; Paul Dozier Cable, of St. Louis, Mo. Application filed Aug. 31, 1888. The combination with a portion of a railway, of local circuits at its respective ends, controlled by the presence of a train, a third circuit controlling signals at the opposite ends and relays in the local circuits, and make-and-break devices along the line, all controlling the third circuit, whereby the trains approaching the section may operate the signals.

421,240. Thermal Cut-Out; Philip Cardew, of Chatham County of Kent, Assignor to Bernard Mervyn Drake and John Marshall Gorham, of Westminster, England. Application filed February 18, 1889. Patented in England, Nov. 12, 1887, and in France, Jan. 24, 1889. In a safety apparatus, a medium interposed between the circuit to be protected and earth, consisting of an insulated plate which is connected to and charged with the potential of such circuit, and a thin strip of foil having its one end situated at a short distance from the insulated plate, so as to be attracted thereby when the plate is charged with high potential electricity while its other end remains in contact with earth.

421,294. Electrical Spray and Vapor Bath; Nathaniel Lyke, of Williamsport, Pa. Application filed Feb. 4, 1889. In an electrical vapor bath, the combination of an electric battery, binding posts with double screw caps within the casing of the bath, which the binding posts are connected with, the poles of the battery, a number of electrodes by which contact with the body of the patient may be made, and a number of bifurcated electrical conductors by which connection between the screw caps and electrodes may readily be made in a variety of ways.

(1) 421,304. Trolley for Electric Railways; (2) 421,305. Overhead Trolley for Electric Railways; Frank B. Rae, of Detroit, Mich., Assignor to the Detroit Electrical Works, of



No. 421,180.—Thermal Cut-out.

same place. Applications filed (1), June 27, 1889; (2), July 1, 1889. (1) In a trolley for electric railways the combination, with a trolley pole hinged at its base, of two diverging hinged arms, each controlling the tension of a spring and the consequent pressure of the spring against the trolley pole, and means attached to the trolley pole for varying the tension of either spring. In a trolley for an electric railway, the combination, with a trolley pole adapted to have practically a universal oscillation or swing at its base, of two springs mechanically connected to the pole, and controlling the direction of swing of the same.

421,320. Collecting-Contact for Electric Machines; Albert Schmid and Edward C. Means, of Allegheny, Pa.; said Schmid Assignor to the Westinghouse Electric Company, of Pittsburg, Pa. Application filed December 7, 1889. The invention consists in applying a flexible contact-band, composed of a woven wire or "linked belt," to the conductor or collecting plates; and further, in providing, where desired, a lubricating substance consisting of a plumbago or similar material embedded in the contact-bands. The open work of the band permits rapid radiation of heat, tending to keep the same from becoming unduly heated. See illustration.

421,339. Door Alarm; John F. Wollensak, of Chicago, Ill., Application filed Oct. 17, 1889. The combination of an electric circuit, a door that may be opened and closed, a spring extending out from the section of the circuit above the door, and a trigger pivoted to the other section of the circuit, adapted to be moved into contact with the spring when the door is swung on its hinges, and released from such contact as the door passes it.

421,340. Electric Compound Push; John F. Wollensak, of Chicago, Ill., Application filed Dec. 16, 1889. In electric pushes the combination of a plate of insulating material binding screws for holding the ends of the circuit wires arranged on the front of the plate, and a face having buttons and springs holding the buttons in place and adapted to be pressed into position by the buttons to complete the circuit, and a frame surrounding the plate and holding the face the proper distance from the plate.

421,371. Electrical Communication; James L. Cutler, of Piketon, Assignor to Joseph A. Sullivan, Frank O. Loveland and Guy Mallon, all of Cincinnati, O. Application filed Aug. 9, 1889. The combination of a transmitting instrument and a series of signals or machines at relay stations with permutation wheels, each permutation wheel being actuated by local electro-magnets controlled from a central station, and adapted to close, when the proper call is made, the circuit which actuates the signal at its station.

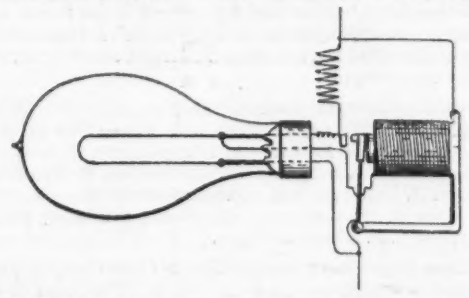
PATENTS EXPIRED FEB. 4, 1890.

135,429. Telegraph Poles; Improvement in Telegraph Poles; Charles F. Howes, of Philadelphia, Pa., Assignor to himself and Ryland W. Howes, of Boston, Mass. A telegraph pole formed of two or more uprights or strips or iron, steel or wood, supported or strengthened by tension wires attached to the pole and held apart by struts or their equivalents, and arranged in relation thereto.

135,531. Circuits for Chemical Telegraphs; Thomas A. Edison, of Newark, N. J., Assignor to himself and George Harrington, of Washington, D. C. One or more electro magnets, arranged in a local or branch circuit, in combination with a chemical telegraphic receiving instrument.

135 574. Improvement in Lightning Rods; William B. Munn, of Cleveland, O. A lightning rod composed of a central wire cable core, or its equivalent, surrounded by a sheet-metal conducting covering, the edges of such covering being tucked away.

135,598. Paper Feeding Machines; Socrates Scholfield, of Providence, R. I., and Charles E. Baker, of Montclair, N. J.



No. 421,207.—Cut-out for Incandescent Lamps.

The invention consists in an improved device for properly securing the uniform separation of the top sheet of a pile of paper from the sheet immediately below it, so that one sheet, and only one, can be drawn at a time.

PATENTS EXPIRED FEB. 11, 1890.

135,690. Improvement in Reversible Magnets; John L. Churchill, of Nokomis, Ill. The invention consists in arranging a series of rotary magnets in a rigid frame which has soft iron end pieces that constitute the reversible poles. The magnets are geared together, so that they will remove simultaneously when one is turned. The invention also consists in the use of peculiar armature plates, affixed to the side of the retaining frame, to neutralize the mutual resistance of the magnets while they are being revolved.

135,751. Paper Ruling Machine; Ellicott David Averall, of New York, N. Y. The invention consists of an electro-magnet armature and striking pen beam actuated by the magnets, and a revolving cam with adjustable sections which operate a circuit breaker and closer. The pen beam is divided at or near the middle of its length to form independent sections for separate or joint action.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patents issued since 1866—can be had for 25 cents. Give the date and number of patent desired, and address The W. J. Johnston Co. Ltd., Times Building, N. Y.